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ElectronicsWeek®

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COMING IN FROM THE COLD

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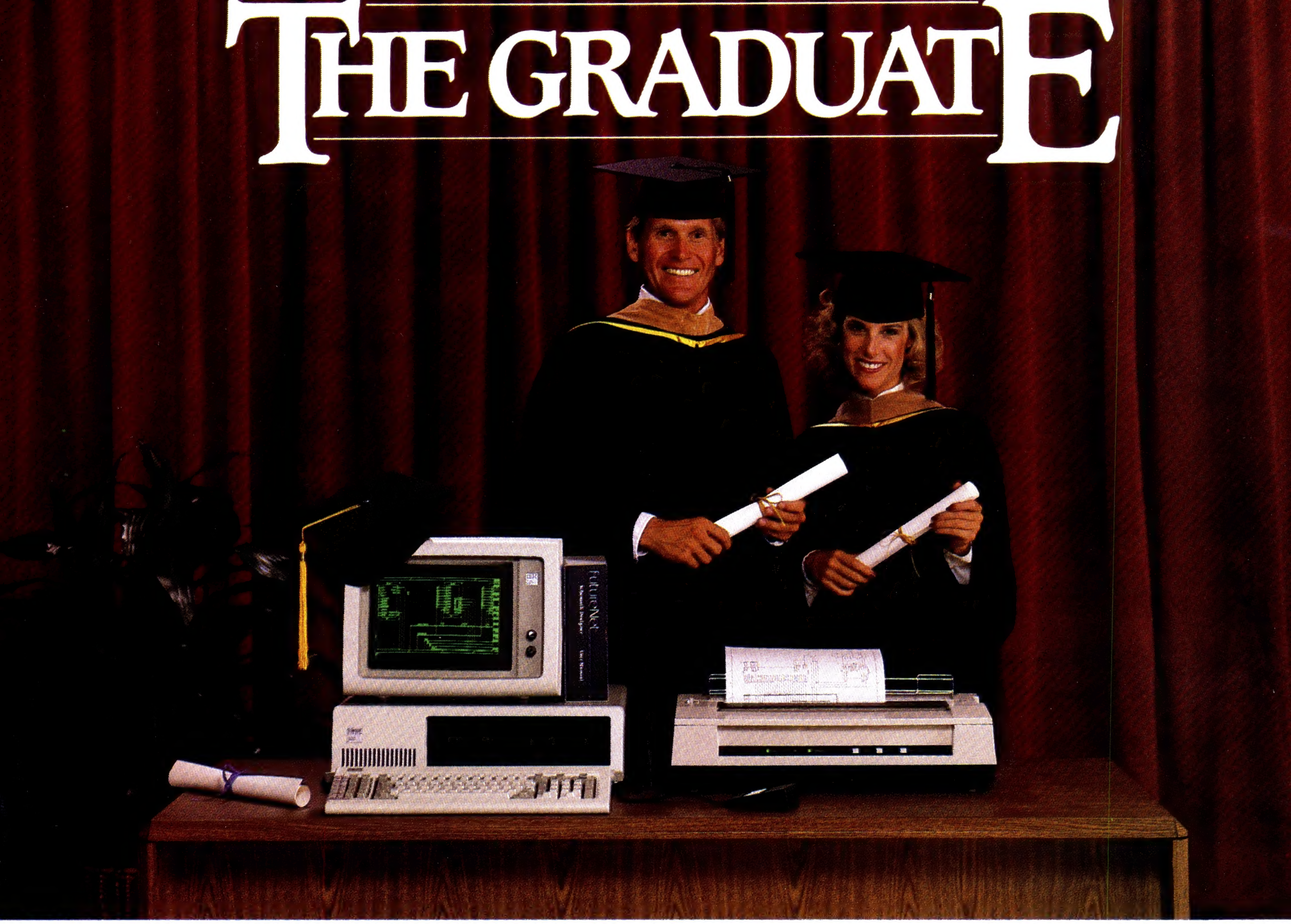

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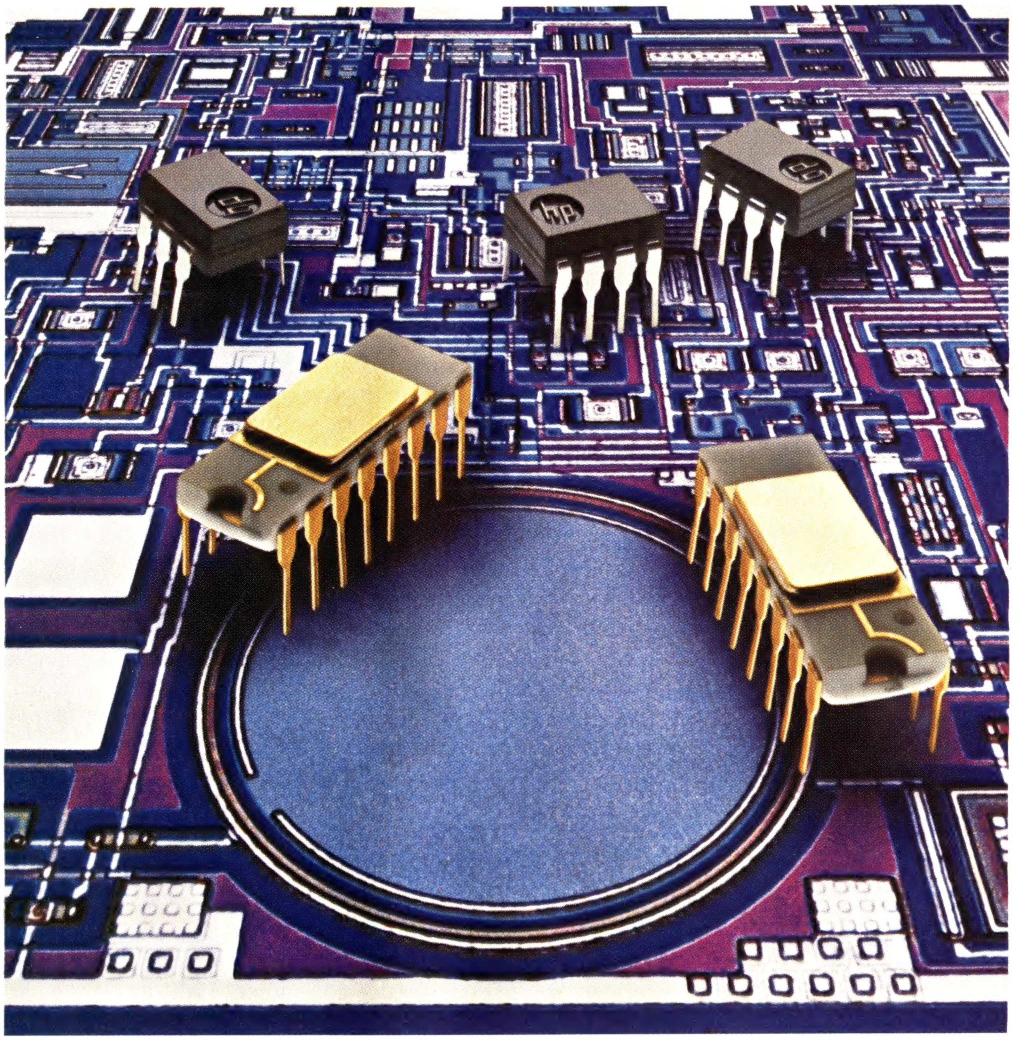

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Next ElectronicsWeek

Unix: can it finally become the industry standard?

Unix, the computer operating system developed by AT&T Bell Laboratories, has become the most popular software since Cobol and Fortran. Most computers made today have some form of Unix available for them. Yet in 15 years, Unix has not made it into the computing mainstream or established itself as a de facto standard. But 1985 may be a watershed year for Unix—when it either breaks through as the operating system of choice for major commercial systems or spells disaster for many vendors looking to cash in on a potentially lucrative market. What's going on in the volatile Unix world is the subject of Tom Manuel's special report in next week's issue.

Interest in ROMs is rekindling

Two years ago, the bottom dropped out of the video-game market, plunging suppliers of read-only memories into a deep hole—from which many never managed to clamber out. But with other memory-chip areas experiencing what might charitably be called a cooling-off period, a potential revitalization of the ROM market is showing up. This awareness is fueled by technology advances that make possible chip densities that couldn't be realized until now and with them new applications. But controversy still rages about big ROM standards. Read all about it in the March 4 issue.

Looking ahead in ElectronicsWeek

The military wants reliability designed in

The Department of Defense allots 25% of its budget to preventive maintenance, and the figure could go higher with the growing complexity of weapons systems. An upcoming *ElectronicsWeek* special report describes how the DOD is working with its vendors to improve both the reliability and maintainability of advanced signal-processing and avionics systems.

February 25, 1985 Volume 58, Number 8
96,912 copies of this issue printed

ElectronicsWeek (ISSN 0748-3252). Published weekly by McGraw-Hill Inc. Founder: James H. McGraw 1860-1948. Publication office: 1221 Avenue of the Americas, N. Y., N. Y. 10020; second class postage paid at New York, New York and additional mailing offices. Postage paid at Montreal, P. Q. Registration Number 9034.

Executive, editorial, circulation, and advertising addresses: ElectronicsWeek, McGraw-Hill Building, 1221 Avenue of the Americas, New York, N. Y. 10020. Telephone (212) 512-2000. Teletype 12-7960 TWX 710-581-4879. Cable address: M C G R A W H I L L N E W Y O R K.

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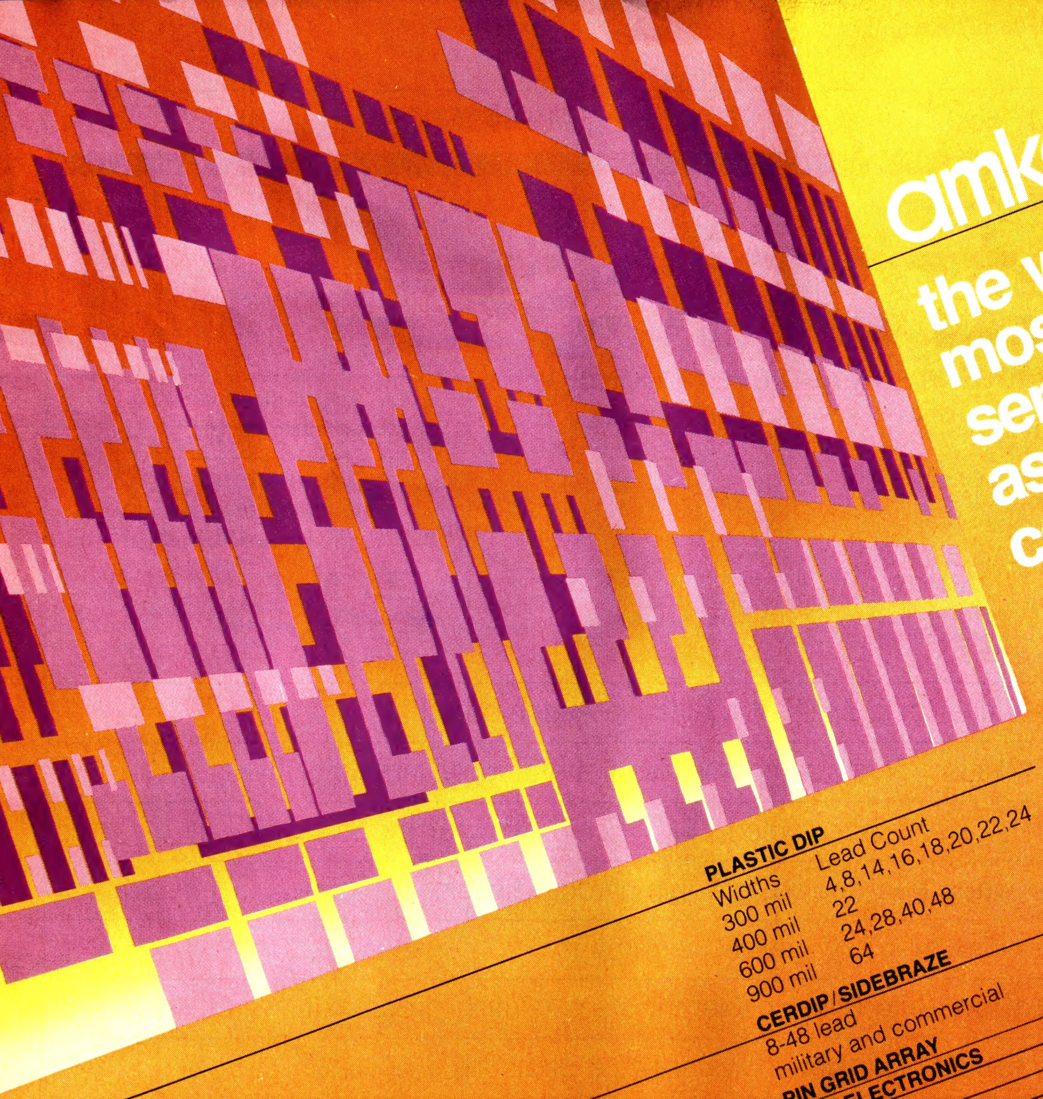

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FOLLOW-UP ON THE NEWS

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ElectronicsWeek

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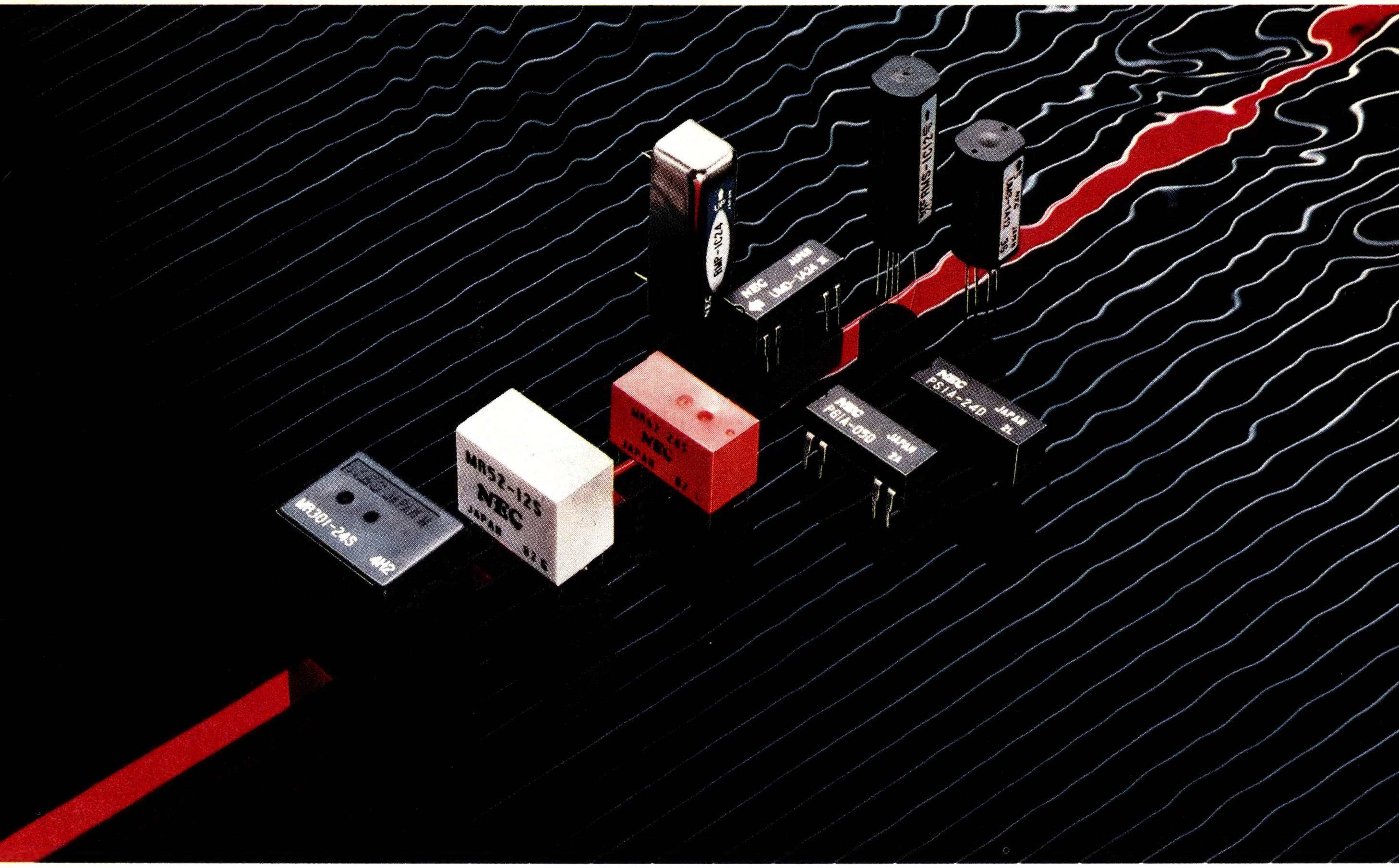
NEC PC board relays pack high reliability.



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Meetings

Successful LAN Management, Sytec Corp. and George Mason University (Tom Spiro, Sytec, 1225 Charleston Rd., Mountain View, Calif. 94043), J.W. Marriott Hotel, Washington, April 3-5.

IEEE/ASME Joint Railroad Conference, American Society of Mechanical Engineers and IEEE, (ASME, 345 E. 47th St., New York, N.Y. 10017), Roosevelt Hotel, New York, April 16-18.

Quality Expo Test, Inspection, Measurement, and Evaluation Conference and Trade Show, *Quality* magazine *(Quality* Expo TIME, 2400 E. Devon Ave., Suite 205, Des Plaines, Ill. 60018), O'Hare Expo Center, Rosemont, Ill., April 16-18.

Network Management/Technical Control Conference and Exposition, Arus Inc. *et al.* (NM/TC Conference and Exposition, Box 880, Framingham, Mass. 01701), Copley Place Marriott, Boston, April 16-19.

Ansys Conference and Exposition, Swanson Analysis Systems Inc. (Jennifer Segedi, Swanson Analysis Systems, P.O. Box 65, Houston, Pa. 15342-0065), Westin William Penn Hotel, Pittsburgh, April 23-25.

ElectroTest '85, Cahners Exposition Group (Cahners Plaza, 1350 E. Touhy Ave., Des Plaines, Ill. 60018), Orange County Convention Center, Orlando, Fla., April 23-25.

Principles and Applications of Drive Systems—Hydraulic and Electric, National Fluid Power Association (Ellen Kendall, National Fluid Power Association, 3333 N. Mayfair Rd., Milwaukee, Wis. 53222), Milwaukee, April 24-26.

Expert Systems and Knowledge Engineering, Gottlieb Duttweiler Institute (T. Bernold, Gottlieb Duttweiler Institute, CH-8803 Ruschlikon/Zurich, Switzerland), Gottlieb Duttweiler Institute, Ruschlikon/Zurich, April 25-26.

16th Pittsburgh Conference on Modeling and Simulation, School of Engineering at the University of Pittsburgh, *et al.* (William G. Vogt, 348 Benedum Engineering Hall, University of Pittsburgh, Pittsburgh, Pa. 15261), University of Pittsburgh, April 25-26.

Workshop on Analytical Simulation Modeling of IEEE 802.4 Token Bus, National Bureau of Standards (Robert Rosenthal, B226 Technology Building, NBS, Gaithersburg, Md. 20899), NBS Administration Building, Gaithersburg, April 29-30.

1985 Society for Information Display International Symposium, Society for Information Display (James N. Price, Naval Ocean Systems Center, Code 7113, San Diego, Calif. 92152), Sheraton Twin Towers, Orlando, Fla., April 30-May 2.

Seminars

Multilevel Interconnect Technology for VLSI Applications, University of California at Irvine—School of Engineering and University Extension (Maria Norris, University of California Extension, P.O. Box AZ, Irvine, Calif. 92716), Emerald Anaheim Hotel, Anaheim, Calif., April 15-17.

Database: A Builder's Guide, Technology Transfer Institute (741 Tenth St., Santa Monica, Calif. 90402), Allerton Hotel, Chicago, April 15-18.

Successful Software Management Seminar, Education Foundation of the Data Processing Management Association (Technology Training Corp., Department SSM, P.O. Box 3608, Torrance, Calif. 90510-3608), Colonial Hilton, Boston, April 15-16; Holiday Inn Fair Oaks, Washington, April 18-19.

New Generation PBX—The Path to Voice/Data Integration, Data-Tech Institute (Lakeview Plaza, P.O. Box 2429, Clifton, N.J. 07015), Milford Plaza, New York, April 17-19.

Database: A Manager's Guide, Technology Transfer Institute (741 Tenth St., Santa Monica, Calif. 90402), Marriott, Los Angeles, April 22-24.

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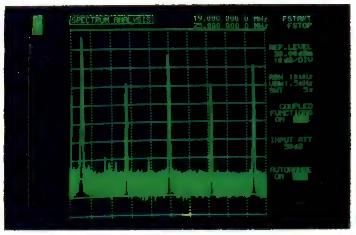

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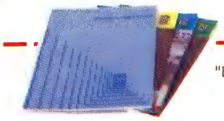

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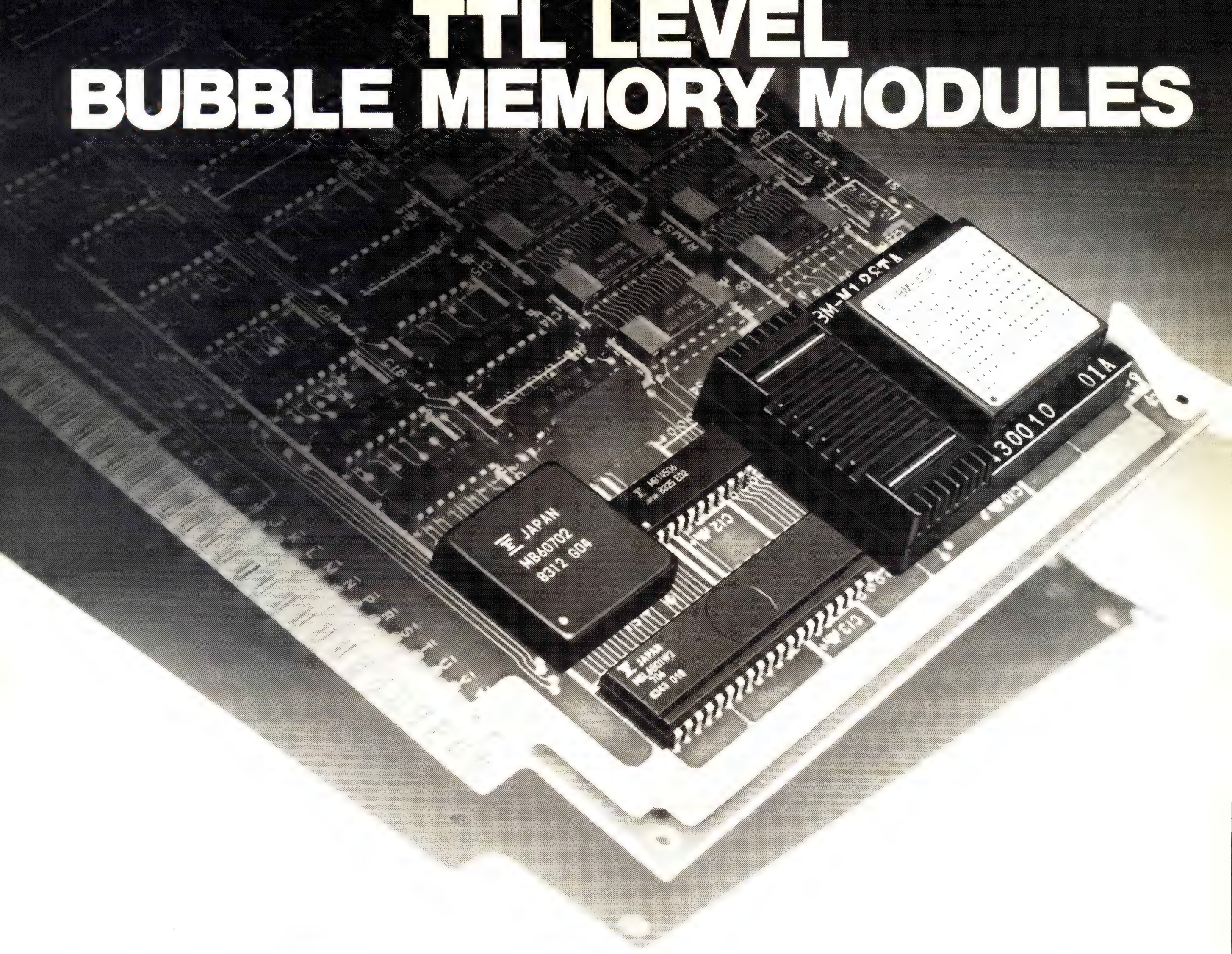

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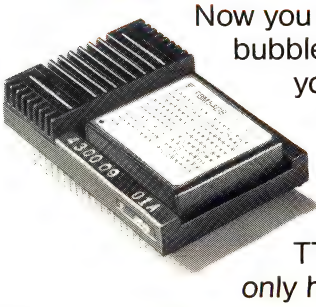

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Interface	TTL level	
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Access time	11.2ms	
Operating temp.	0 to 65°C	5 to 50°C
Storage temp.	−40 to 85°C	−30 to 75°C
Weight	75g	
Dimensions	43.5 x 65.5 x 13.7mm	

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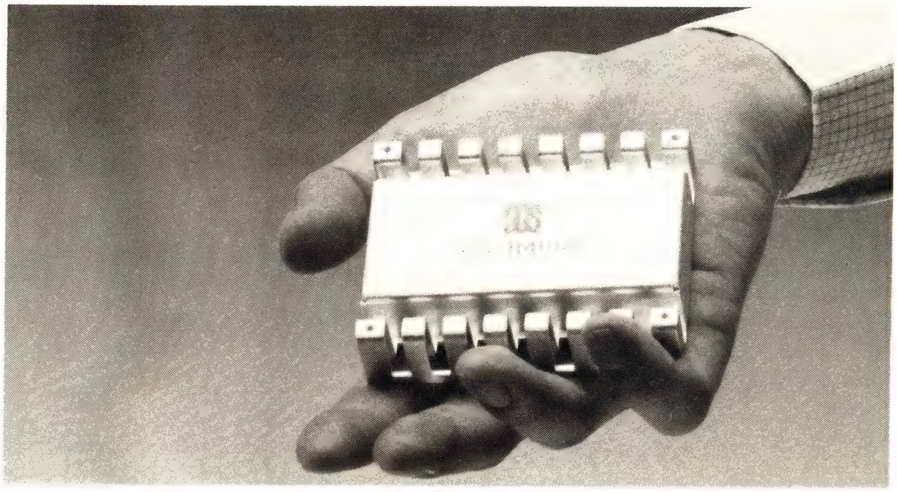

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TYPE	INPUT VOLTAGE V	OUTPUT VOLTAGE V	OUTPUT CURRENT A	CURRENT LIMIT A	AVG SHORT CIRCUIT CURRENT – A	SWITCHING FREQ. kHz	LINE REGULATION dB	LOAD REGULATION mV/A	TEMP. STABILITY mV/°C	INHIBIT VOLTAGE V	RESET OUTPUT	CROWBAR INTERVENTION V	MAX. CASE TEMP. °C	OUTPUT NOISE mV	EFFICIENCY
GS-R405	8-48	5	4	5	0,5	100	60	20	0,2	5	No	6	75	25	75
GS-R405S	8-48	5	4	5	0,5	100	60	20	0,2	5	Yes	6	75	25	75
GS-R412	15-48	12	4	5	0,5	100	60	40	0,5	5	No	15	75	30	85
GS-R415	18-48	15	4	5	0,5	100	60	60	0,6	5	No	18	75	40	90
GS-R424	27-48	24	4	5	0,5	100	60	90	1	5	No	29	75	50	90
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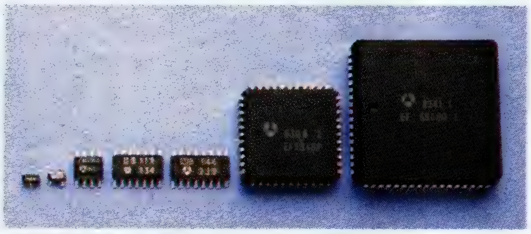

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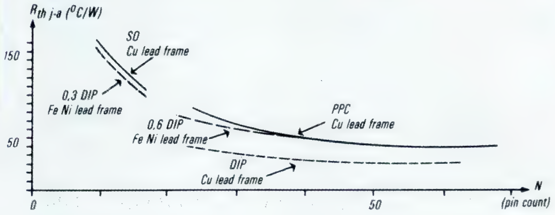

Junction-ambient air thermal resistance, components reported on classical PC board (FR 4, 1.3 mm thickness, 50 x 50 mm size).

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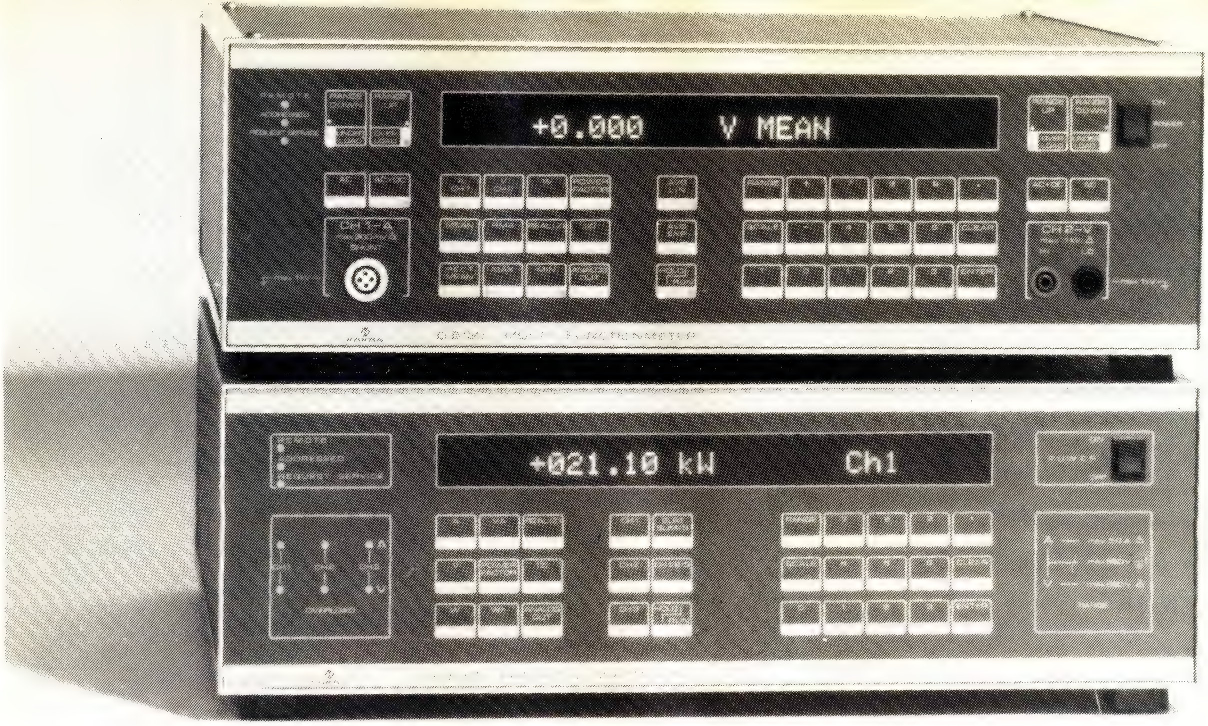

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D 4135 IEC 625	MULTI-FUNCTIONMETER	0–150 kA / 500 V 75 MW
D 4155 IEC 625	PRECISION WATTMETER	0–10 A / 550 V / 11 kW
D 5155 IEC 625	AC POWER ANALYZER	0–50 A / 650 V / 100 kW
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VHSIC HITS NEW LEVELS OF ACCEPTANCE

Contrary to the expectations of many insiders—including some of its architects—the Defense Department's VHSIC program has heard few discouraging words and is now soaring to high levels of industry acceptance. A controversial issue when launched in the late 1970s, the Very High Speed Integrated Circuits program has confounded critics with its success. These doubters, whose numbers are on the decline now, largely came from the ranks of semiconductor industry officials who feared that VHSIC would dilute scarce design talent. In addition, they thought that any technological developments would be held so closely by secretive bureaucrats that little fallout would benefit the commercial IC lines that pay the bills. Neither fear has materialized, although some carping continues about the latter worry.

The true measure of success for VHSIC is getting its chips inserted into weapon systems. The program has generated so many new prospects over the past year that it appears poised to rack up more scores. VHSIC/Electron Devices director E.D. (Sonny) Maynard Jr. leaves little doubt that the impetus to insert VHSIC is shifting to the user. "We have just completed the tri-service review of ongoing technology insertion and discussed proposals for new starts. And I can tell you we looked at a lot of new things, which we scrubbed up for consideration." At year-end, VHSIC had signed up 38 programs to use the 1.25-micron chips developed by contractors during Phase 1 of the program [*ElectronicsWeek,* Dec. 17, 1984, p. 57].

But selling weapons-industry managers on using these chips is essentially a merchandising mission. Now and then, it hits a DOD roadblock, erected to keep technical data from getting into the wrong hands. An example is this month's Winter Convention on Aerospace and Electronic Systems meeting, where Maynard and three Phase 2 contractors were to brief attendees in an open session (most sessions are classified). But Wincon classified the VHSIC program, which reportedly included little new information from the TRW, IBM, and Honeywell speakers. VHSIC managers, however, will keep trying to get their message out in the face of defense officials who are quick to pull the information plug. Such snafus are the mark of the large, unwieldy organizations that VHSIC had to overcome, says Maynard. In fact, the VHSIC director thinks his program represents "the triumph of technology over bureaucracy." Because its record stands in contrast to many other DOD programs—which are often marred by cost overruns, operating troubles, and squabbling over funding—it is coming to the attention of military planners. Some of its techniques for central direction of multicontractors already are being emulated in such newer programs as the Strategic Defense Initiative, say sources.

As for VHSIC's technology, a steady stream of developments is coming along, Maynard reports. If any shortcoming exists, it is a familiar bugaboo—the lack of standard software packages for the different Phase 1 chips, both for developing operating programs and evaluating them. One enthusiastic backer of the insertion program says this problem also dogs commercial users. "But it happened sooner with VHSIC because the weapons programs are so sophisticated and complex," Maynard says. Maynard and his managers are aware of the software shortfall and plan to step up corrective efforts. ☐

UP FRONT

European computer makers pick Unix for applications work

In an apparent attempt to arrive at a common operating system for their hardware, six European computer makers have banded together to develop applications software using AT&T Bell Laboratories' Unix operating system. The six—Bull, Ing. C. Olivetti & Cie., Nixdorf Computer AG, Siemens AG, International Computers Limited plc, and N.V. Philips—now have proprietary (and noncompatible) operating systems for their hardware. The gang of six say they want to develop a common application-software environment, which they describe as a set of tools—such as languages, compilers, and software for work stations and data-base management—that can define the interface upon which software houses can base their work. The definition of that application-software environment will be published throughout 1985. The firms say the resulting operating system will be widely available to all users, software vendors, and other manufacturers and will not be proprietary. No decision has yet been made on which of the many forms of Unix the six will choose. AT&T owns 25% of Olivetti, however, and the two firms have a London subsidiary to promote Unix. ☐

Intel lays off 900 as industry slump continues

Rumors of impending layoffs at Intel Corp. became fact last week when the Santa Clara, Calif., semiconductor manufacturer disclosed that it would shut down two plants completely and reduce its workforce at two others. The firm will also reduce its work week to four days at two of its seven wafer fabrication plants. In all, some 900 workers will be laid off, and 800 will be cut back to a four-day week. Intel sales in the first quarter of fiscal 1985 were down 10%, to $375 million from the $416 million recorded in the fourth quarter of last year. ☐

First Kurzweil speech recognizer ready for market

The Kurzweil Voice 3000, which can recognize and print out 1,000 words of spoken vocabulary, will be available by the third quarter of this year, *ElectronicsWeek* has learned. According to a source at Kurzweil Speech Systems, Waltham, Mass., the KV 3000 contains 3,000 speech tokens that store the dialect variations necessary for speaker-independent operation. Although the price is not yet firm, Kurzweil foresees applications in word processing, spreadsheet operation, data-base inquiry, credit verification, telephone management, and machine control. ☐

U.S. electronics trade deficit could hit $12 billion in 1985, AEA says

If present foreign trade patterns continue this year, the U.S. trade deficit in electronics will reach a record $12 billion, the American Electronics Association predicted last week. The deficit was $6.8 billion in 1984. The largest single deficit was with Japan, which exported $18.1 billion worth of electronics goods to the U.S. but brought in only $2.7 billion of U.S. products. The AEA, which labeled as conservative its forecast for the 1985 overall trade deficit, predicted that the Japanese trade gap would probably rise to $20 billion. AEA senior vice president Ralph Thompson said the high value of the dollar and cumbersome export restrictions account for some of the deficit. But the chief reason is that "some of our international trading partners regard doing business with the U.S. as essentially a one-way street." ☐

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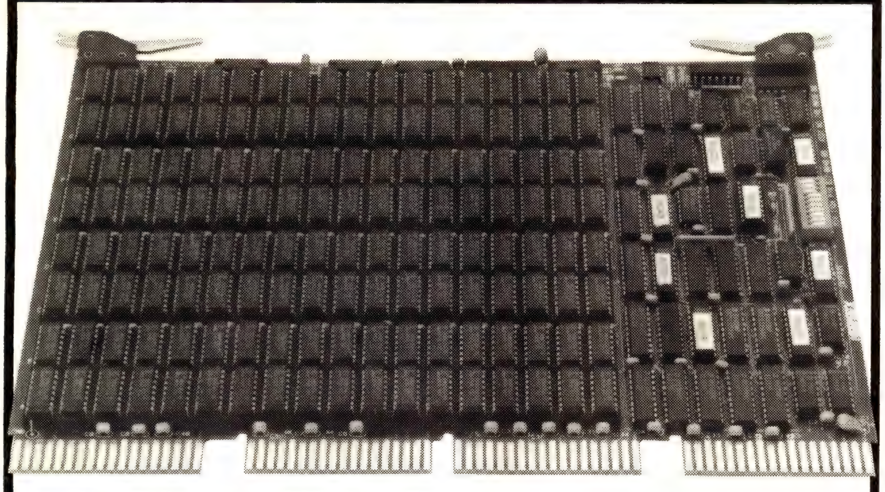

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STUDY RANKS TOXIC SPILLS

California water board calibrates sites in Silicon Valley as threats to drinking supply, while industry report stresses cleanup

☐ *by Clifford Barney*

Palo Alto

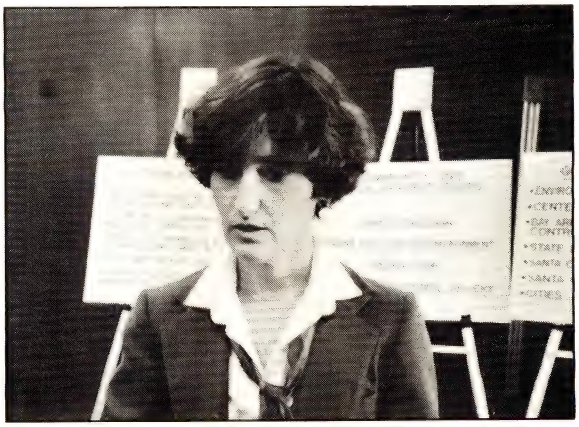
For the first time since the problem developed, residents of Silicon Valley know to what extent their drinking water is threatened by leaks and spills of toxic chemicals.

The San Francisco Bay Regional Water Control Board issued a first tentative calibration this month of the extent of ground contamination by toxic wastes from electronics firms and others. Existence of the spills has been known for several years, but the list just issued is the first to rate the firms' relative danger to the water supply.

The water board ranked the 46 sites in San Jose, Santa Clara, and Sunnyvale according to toxicity and amount of chemicals spilled, and the likelihood of their reaching the water supply. The water board's report did not take into account cleanup efforts that may have been started at some of the sites.

The purpose of the ranking was to enable the water board's 14-member toxics staff—hard-pressed by the need to identify, monitor, and control the cleaning up of over 100 spills—to make sure that the worst spills get taken care of first. The board, a state agency with members appointed by the governor from industry, municipal government, and agriculture, has requested an additional 22 staff positions for work on analysis and cleanup of toxic wastes in the Bay Area. This move is supported by the electronics industry through its Clean Water Task Force.

The task force, meanwhile, issued its own report on cleanup of the same sites. It showed that of the 43 found by the water board to require cleanup, 35 were in the investigation and initial cleanup stage, with only eight approved for full-scale cleanup.



More money. Megan Taylor, head of the Industry Clean Water Task Force, calls more funds for the water board a top priority.

The director of the task force study said a major bureaucratic logjam is likely to occur when the 29 firms still in initial cleanup submit detailed plans to the board in the next few months.

Increase in leaks. Most of the leaks date from several years ago, when single-walled tanks were used for storage of solvents. Double-walled tanks are now required by local and regional ordinances. Two years ago, there were 77 confirmed leaks; today, there are nearly 300.

The spills involved are mostly of solvents that leaked from storage tanks outside electronics plants and at chemical distribution and waste disposal firms. Many of the chemicals are suspected carcinogens and teratogens (agents that affect the reproductive process).

Last month, two state epidemiological studies showed a significant statistical excess of birth defects and spontaneous abortions in an area that draws water from supplies near one of the worst spills. That study stopped short, however, of attributing these problems directly to the leak.

As expected, spills at two south San Jose plants that are owned by IBM Corp. and Fairchild Camera & Instrument Corp. were near the top of the board's initial list (see table). The danger of toxic spills first came to light in 1981, when these firms discovered leaks.

Majority electronic. Of the 46 sites listed, 40 are associated with electronics companies and all but one of the rest with solvents-handling firms. (The exception is a nursery.) The water board will evaluate 24 sites in five nearby Bay Area communities in May and add them to the ones that it ranked this month.

The water board based its ratings partly on data obtained from the companies involved and partly on its own geographical data on the water supply. Adam W. Olivieri, the engineer in charge of preparing the report, said most of the firms reviewed the material after the board had organized it. He does not expect many challenges to the rankings.

Larry Borgman, manager of facilities planning and engineering for Intel Corp. and a leader in industry efforts to clean up the spills, said the water board's list was useful because "It [the board] needed some way to prioritize the problems." He noted, however, that much of the information was outdated in that it did not include data on cleanup efforts that have already begun.

The rankings were based on seven main factors: the magnitude of the contamination, including the number of chemicals and their toxicity; the physical and chemical properties of the chemicals; their toxicity; the distance between the spill and the point of water use; the depth of the water supply and the soil's porosity; the extent of the chemical's use; and the direction and angle of flow of the underground water supply. The magnitude of contamination is weighted highest, counting 60 points. The depth to the water table is second, at 50 points. Gradient of the water table is least important, at 10 points. The worst possible score is 230.

Last October, the American Electronics Association, the Semiconductor Industry Association, the Santa Clara County Manufacturing Group, and the Electronics Association of California funded the Industry Clean Water Task Force, with a charter to provide information on industry cleanup efforts. Its initial report, issued the day after the water board's list appeared, emphasized the progress already made. "The vast majority of the sites requiring cleanup . . . are involved in advanced remedial programs," says Megan Taylor, director of the task force.

Just starting. The task force's report, however, notes that 35 sites have advanced only to investigation or initial cleanup. Before advancing to full-scale cleanup, companies must submit a detailed plan to the water board for evaluation. Without more staff, Taylor said, the board would bog down in the paperwork. She called more funds for the water board a top priority.

As a practical matter, Taylor said, many firms have not waited for formal approval to begin cleanup. But they cannot discharge contaminated groundwater or vent toxic chemicals through airstripping without permits that will be available only when the approval is granted.

DRINKING-WATER THREATS IN SANTA CLARA COUNTY, CALIF.

Ranking	Threat score	Company	Location
1	193.50	Solvent Services Co.	San Jose
2	175.50	IBM Corp.	San Jose
3	172.10	Fairchild Camera & Instrument Corp.	San Jose
4	169.50	Van Waters & Rogers Corp.	San Jose
5	169.00	Pacific Nursery Pots Inc.	Santa Clara
6	166.40	National Semiconductor Corp.	Santa Clara
7	163.30	Magnex Corp.	San Jose
8	160.80	Technical Coatings Inc.	Santa Clara
9	160.60	Westinghouse Corp.	Sunnyvale
10	159.70	Avantek Inc.	Santa Clara
11	157.50	Lorentz Barrel and Drum Co.	San Jose
12	156.40	TRW Inc.	Sunnyvale
13	156.20	Applied Materials Inc.	Santa Clara
14	156.00	Signetics Corp.	Sunnyvale
15	154.60	Memorex Corp.	Santa Clara
15	154.60	Hewlett-Packard Co.	Sunnyvale
17	153.00	Xidex Corp.	Sunnyvale
17	153.00	Signetics	Sunnyvale
19	152.00	Advanced Micro Devices Inc.	Sunnyvale
20	149.20	Monsanto Co.	Santa Clara
21	147.00	Precision Media Corp.	Sunnyvale
22	145.50	American Microsystems Inc.	Santa Clara
23	145.00	Spectra Physics Corp.	Santa Clara
24	144.60	Precision Monolithics Inc.	Santa Clara
25	144.50	Advanced Logic Systems Inc.	Sunnyvale
26	143.70	Intersil Inc.	Sunnyvale
27	143.00	United Technologies Corp.	Sunnyvale
28	142.90	Fairchild	Santa Clara
29	142.00	Verbatim Corp.	Sunnyvale
30	136.20	Ampex Corp.	Sunnyvale
31	136.00	Circo Inc.	Sunnyvale
32	134.70	KTI Chemicals Inc.	Sunnyvale
33	133.50	AMD	Sunnyvale
34	132.10	Signetics	Sunnyvale
35	131.40	Monolithic Memories Inc.	Sunnyvale
36	130.60	Dysan Corp.	Santa Clara
37	129.90	MMI	Santa Clara
38	129.50	Magnetic Peripherals Inc.	Santa Clara
39	126.50	Synertek Inc.	Santa Clara
40	125.40	Exar Integrated Systems Inc.	Sunnyvale
41	122.60	Intel Corp.	Santa Clara
42	120.60	Data General Corp.	Sunnyvale
43	119.70	HP	San Jose
44	117.10	Zymos Corp.	Sunnyvale
45	110.70	Intel-Magnetics	Santa Clara
46	109.10	Dysan	Santa Clara

Scores are weighted figures that depend on magnitude of contamination, properties of pollutants, toxicity of chemicals that leaked, gradient and flow direction of drinking-water supply, depth of supply and porosity of soil, extent of present water use, and distance between spill and point of water use.

SOURCE: SAN FRANCISCO BAY REGIONAL WATER QUALITY CONTROL BOARD

The task force suggested that the state or the Environmental Protection Agency provide the board with a computerized management-information system so it could better monitor the cleanup's rate of progress. The task torce also recommended that local authorities consider relaxing some environmental regulations on air and water discharge to speed the cleanup. ☐

SPEED, SIZE MARK COOLED CMOS CHIP

St. Paul, Minn.

Eextremely dense gate arrays cooled to liquid nitrogen temperatures will form the basis of a new superconducting computer that will operate at a mind-boggling billions of floating-point operations per second.

ETA Systems now has in its hands prototype versions of the arrays. Their 20,000 gates put them in the same giant class as the parts that Fujitsu Ltd. and Toshiba Ltd. described in mid-February at the International Solid State Circuits Conference, in New York. But what really sets the ETA arrays apart is their speed—a gate delay of 400 ps when cooled to liquid nitrogen temperature (77 K). Even at room temperature, typical gate delays are a very respectable 800 ps. So although ETA designed the arrays for its forthcoming ETA^{10} supercomputer, the chips may turn up in more conventional equipment as well. Honeywell Inc., which fabricates the chip for ETA, is currently negotiating for rights to offer the circuit on the commercial open market—perhaps as soon as 1986.

Plant shift planned. Early versions of the ETA array, built in Honeywell's 1.25-μm, single-polysilicon, double-level-metal n-well process, are being fabricated at the Honeywell Solid State Device Center in nearby Plymouth, Minn. But production will ultimately be shifted to Colorado Springs. There, Honeywell is constructing a $50 million plant to build 1.25-μm CMOS and bipolar circuits for the Defense Department's Very High-Speed Integrated Circuits program and for other high-performance applications.

Though ETA describes the chip as a 20,000-gate array, it actually contains about 22,000 gates, counting clock drivers, input/output buffers, a built-in functional test capability and other fixed circuitry. This leaves about 18,000 programmable gates in the matrix. ETA figures that up to 80% of these gates will be used in layouts made with its computer aided design software. The firm is working with a library of macrocells that range up to 72 basic six-transistor cells.

The circuit, which is known internally at ETA as the ALSI 20K array, incorporates a number of design features that set it apart from the current generation of commercial CMOS arrays, says Randy Bach, senior technologist at ETA.

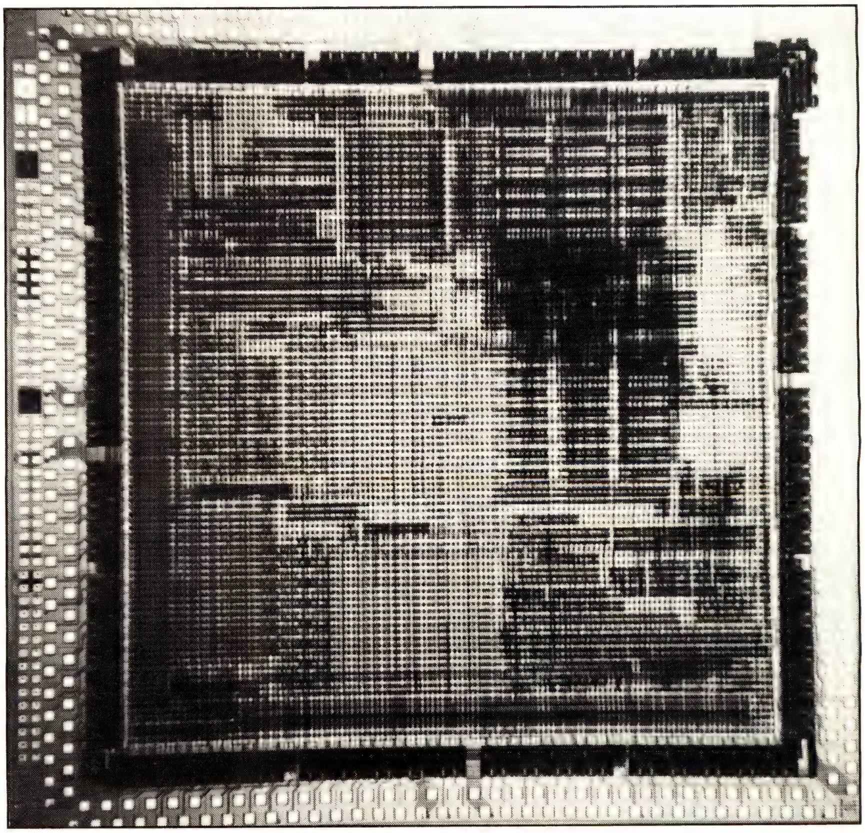
One difference is that ETA has placed power and ground buses on the second configurable metal layer. This does away with the contention problems inherent in the usual arrangement, in which bus metal is placed on the first layer.

Another difference is that, unlike conventional arrays, the ETA chip permits macrocells to cross both row and column boundaries. Thus they can be made in any rectangular configuration.

Yet a third distinguishing feature is that all six poly gates in each matrix cell are individually accessible. This eases routing. It also will allow ETA to optimize delays by tying certain transistors together in series or parallel configuration.

The combination of cross-column routability and access to individual transistors in the cells improves the array's performance by perhaps 10% to 15%, Bach estimates.

Tightly packed. Similar advantages come from the fact that ETA routing software developed for the chip will enable any channels that are unused within a particular macrocell to be used for first-layer cross-chip routing, Bach adds. This is impossible with conventional CAD routing programs, which allow routing over active cell areas only on the second level. This again makes for tighter packing of the ETA array by reducing the number of routing channels necessary between columns. Compared with commerically available



20,000 plus. ETA's gate array carries 22,000 gates. The programmable matrix has 18,000 gates; peripheral circuits, such as I/O buffers and clock drivers, account for the balance.

6,000- and 8,000-gate CMOS arrays, which carry 16 to 20 routing channels between columns, only seven channels between columns are necessary on the ETA chip, Bach says.

Built-in test. Other features of the ETA chip include built-in functional test capability, a function that takes up about 5% of the circuit's 1-cm^2 area. "Some gate arrays have some cursory stuff around the periphery that allows them to force outputs to enhance parametric testing," Bach says. "But I don't know of any others that have a full built-in functional test." Most commercial-array manufacturers recommend implementation of a testing technique such as level-sensitive scan, which can eat up as much as 30% of the gates in the matrix, the ETA official adds.

Though ETA has developed sophisticated CAD layout software designed to take advantage of features such as individual transistor accessibility, cross-column routing, and channel routing over active areas through a macrocell, most commercial packages can't accommodate such methods. Thus any commercial offering of the chip by Honeywell or other firms would require specialized CAD software as well.

"We recognize that problem, and we obviously can't offer to sell this chip to somebody until we've resolved that," says John D. Bryant, gate-array business manager at Honeywell's Digital Product Center in Colorado Springs. He notes that Honeywell has a significant in-house design-automation capability for developing such software, while another option could be the licensing of ETA software.

Gigaflops. In all, for its uses, ETA will require about 6,000 arrays during 1986, when the first shipments of the ETA^{10} are to begin. The multiprocessor ETA^{10} will be offered initially in either a four- or eight-processor configuration, with each processor using about 250 arrays running at 77 K.

In addition, about 500 of the arrays will be used at room temperature in each ETA^{10} system sold for fixed logic in memory and I/O interfaces. In its full-blown eight-processor configuration, the ETA^{10} will deliver maximum speeds in the range of 10 billion floating-point operations per second. **–Wesley R. Iversen**

MASS STORAGE

VIDEO-DISK MEMORY GETS A NEW IMAGE

Paris

By devising a method for dramatically improving the resolution of a standard video-disk player, a team of French engineers has opened up a nearly unlimited range of archive applications for video-disk storage.

Until now, such applications have been restricted to alphanumeric information or to high-contrast drawings and photos. But at Paris's Centre Mondial organization, which was established by the French government in 1982 to promote computer literacy, engineers have come up with a way of broadening a video-disk system's bandwidths to allow clear reproduction even of images having very fine detail.

What's more, the monochrome system is compatible with standard TV channels. This means that catalogued material from photograph and art libraries could be consulted at long distance.

Multitrack recording. Standard video-disk systems use a single circular track to record a static image. The Centre Mondial's high-density system improves the resolution by increasing the number of tracks used to record a single image. There's no theoretical limit to the number of tracks that can be assigned to a given image, so the only real restraint on resolution is determined by whatever the camera and monitor can handle.

Basically, the system works like this: a 15-MHz signal coming from a Siemens AG high-definition camera is sampled at 30 MHz and converted to 8-bit-wide digital data. The data is then multiplexed across an input bus and passed onto a predetermined number of random-access-memory cards.

In the Centre Mondial's prototype system, there are six cards, each with a capacity of 900 megabytes. The system provides one byte for each pixel that the camera and monitor of the 1,125-line TV system can resolve.

Both the memory cards and the sampling at analog-to-digital and digital-to-analog conversion are managed by a logic card that uses the output of a 30-MHz oscillator as a reference signal. When the data stored on the RAM cards is multiplexed through an output bus, it is sampled at 6 MHz and converted to a 3-MHz analog signal. This signal, in turn, is recorded on a standard video cassette.

The cassette is then sent to a disk engraver, who produces the video disk. Conceivably, the user of the system could choose to engrave the disk himself. But that would wind up being too costly, except perhaps in very high-volume applications.

When multiple video-disk tracks are laid down for each image, the video camera and monitor—not the recording system—determine the limit on resolution.

To view the image, it must be sent back through the system in the opposite direction. The video-disk player is used for input, bypassing the cassette recorder that is used for output when creating the image. A high-definition monitor takes the place of the camera. Going through the system this way, a standard video-disk machine's 3-MHz signal input becomes a 15-MHz high-resolution output signal to drive the monitor.

The Centre Mondial's current monochrome setup will be replaced by a color version later this year. The key here will be to triple the memory capacity of the cards to accommodate the red, green, and blue signals of a color TV receiver. The French Ministry of Culture is exploring the use of the system for cataloguing in the country's libraries and museums. **–Robert T. Gallagher**

BRITONS SEEK TOLERANT CHIPS

Developing fault-tolerant circuits is crucial in opening the way to both bigger chips and wafer-scale circuits ☐ *by Kevin Smith*

London

If some means could be found to sidestep the inevitable wafer defects that lower yields during microcircuit production, the way would be opened to make bigger and more complex chips. Even wafer-scale integration might fulfill its long-held promise.

A British collaboration between industry and academia—part of the UK's $350 million fifth-generation computer effort—aims to do just that. The $2.5 million, three-year program has two complementary objectives. The first is to evaluate and refine different fault-tolerant techniques so that general-purpose chips with 1-in. sides can be made economically. These would be about 10 to 20 times larger and more complex than today's very large-scale-integration chips.

The second, longer-term goal is to evaluate a variety of data- and signal-processing architectures suited to wafer-scale integration. The project aims to put several thousand processors on a wafer, with fault-avoidance circuitry to bypass faulty processors. Two demonstration projects—one for each program objective—will be selected at the end of the first year.

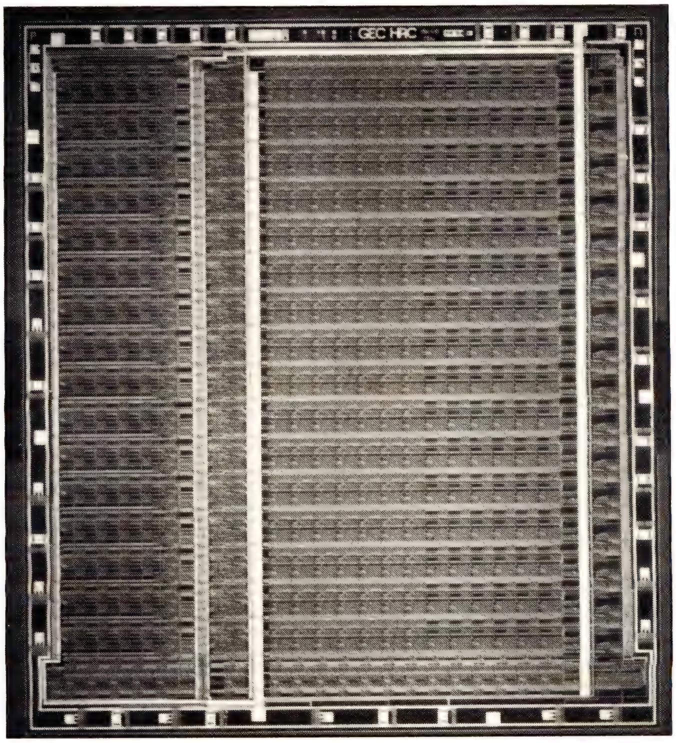
Three of Britain's biggest equipment manufacturers—General Electric Co. plc, Plessey Co., and International Computers Limited—together with three British universities—Brunel, Middlesex Polytechnic, and Kings College—are taking part. Edinburgh and Southampton universities, both with research activities in fault tolerance, will likely participate [*ElectronicsWeek,* Aug. 13, 1984, p. 28].

One conspicuous absentee is Sinclair Research Ltd. The firm's founder-director, Sir Clive Sinclair, decided against participating because his company's wafer-scale project is too close to market. The company plans to launch a solid-state "Winchester disk" based on a half-megabyte wafer-scale circuit late this year (see "A Catt's in Sinclair's pipeline," p. 21). Besides, Sinclair is critical of the collaborative approach of Britain's fifth-generation computer research. He thinks it should be concentrated in a national laboratory, as it is in Japan.

John Dickson, who will direct the program from Plessey's Caswell Research Centre, presides over a wide diversity of proposals. Yet, he says, they have common elements, and it makes sense to lump the projects together.

Good yield models are important to each area, and architectural developments in one area may be useful in another. Also, there is a common need to develop self-testing methodologies. Middlesex Polytechnic will be looking at many of these shared problems at the chip and wafer level.

Fault tolerance, of course, is already used in production to make bigger memory chips. Now, Plessey, GEC, and Brunel University want to add fault tolerance to circuits other than memories. They argue that fault tol-



Makes it easy. Fault tolerance may soon be added to chips with a regular array structure, such as this GEC CMOS signal convolver circuit.

A Catt's in Sinclair's pipeline

Durable. Fault-tolerant technology worked out by Ivor Catt 14 years ago may be used in fifth-generation chips.

While most UK electronics companies with wafer-scale ambitions are banding together to fund research in integration, Sinclair Research Ltd. is going it alone. It plans to launch its first wafer-scale product in the fourth quarter of this year. The circuit will be teamed with Sinclair's 32-bit QL microcomputer and used as a small-capacity replacement for a Winchester disk drive. With half a megabyte of serial memory, it would have a power consumption of 1 W and an estimated access time from 10 to 100 μs, making it at least 100 times faster than its electromechanical counterpart [*ElectronicsWeek*, Sept. 10, 1984, p. 18].

Sinclair reckons that the same self-testing, fault-tolerant technology could be used to make fifth-generation wafer-scale computers operating in a pipelined fashion. The company's basic scheme was worked out by the British electronics engineer Ivor Catt 14 years ago and was subsequently refined in several UK research laboratories. The technique works even when many chip sites—all identical serial registers with a small amount of additional switching and control logic—are faulty. Good chips link up to form a single structure without additional metallization or even prior knowledge of which chips are good. Neighbor-to-neighbor connections are made by simple gate structures, while test patterns, injected at one end of the chain, check that each new link—or chip site—is good. Test patterns and control signals are injected into the chain under control of an external microprocessor, which adds to the chain until a predetermined length has been reached.

Such a setup, figures Sinclair, could be considerably cheaper and more reliable than memories made from standard chips. That's because the bulk of a microcircuit's manufacturing cost is in the labor-intensive end stages. Each silicon wafer, containing several hundred potentially good chips, must be probed to spot the duds. Then the wafer is broken into separate chips, good chips are packaged, wired up, and retested. **–K.S.**

erance can be used to improve yields or make bigger chips.

But, says Plessey's Dickson, this first program will not go beyond chips measuring 1 in. on a side, the limit of current packages.

Plessey and GEC have different design philosophies. GEC figures that fault tolerance can best be applied to circuits with regular array structures. It will first try out its idea on signal-processing chips similar to the convolver and correlator circuits it already has in first silicon (see photo). These have a highly regular structure and are designed as bit-level systolic arrays.

Bypassing trouble. In GEC's approach, multiplexer switches are used to bypass faulty columns and maintain connectivity between bit-serial processors in the array. The application may sound specialized, but Andrew McCabe, who heads the GEC program, points out, "These circuits, once regarded as highly specialized and of immediate interest only to a few engineers, are becoming increasingly important architectures for high-performance dedicated VLSI microcircuits. With modern architectural design techniques, regular structures can account for by far the largest part of VLSI circuit area."

Fault tolerance could also be applied to the image-processing chips under development at Brunel and GEC. GEC's GRID (for GEC Rectangular Image and Data Processor) contains 32 identical processors on a chip, while Brunel's Scape (for Single Chip Array Processing Element) packs 256 image processors onto a single highly regular chip.

Plessey, meanwhile, thinks that fault tolerance could be an addition to its Macrocell custom-design library. Macrocell is powerful because it comprises such large functional building blocks as arithmetic logic cells and read-only and random-access memories [*ElectronicsWeek*, Oct. 1, 1984, p. 19].

Because the library is parameterized, the designer can specify, for example, the size of memory he wants and whether it is to be square or long and narrow. Fault tolerance would only be added to the larger and yield-critical cell blocks such as memory. Then, when all the cells are put together in a completed design, the final chip can be made with improved yields.

On-chip test circuitry would be used to identify faulty cell blocks, which could then be patched with redundant circuitry. International Computers Limited, which collaborated with Plessey on Macrocell's development, will be advising on how fault tolerance could be used by the system designer.

While industry has been working out how to apply fault tolerance to general chip design, the universities have been looking at special-purpose architectures suited to wafer-scale integration. Most of these schemes envisage covering the wafer with a regular array of special-purpose processors with fault-avoidance logic to bypass faulty processors.

Wafer-scale integration, academics argue, presents the opportunity to break away from the Von Neumann architectural straitjacket, in which a single processor is teamed with a single memory. Arrays of highly parallel processors, if mapped onto a sin-

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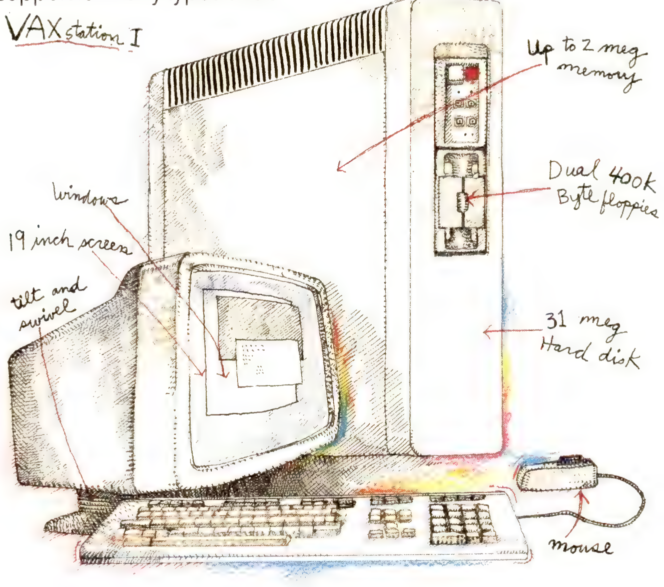

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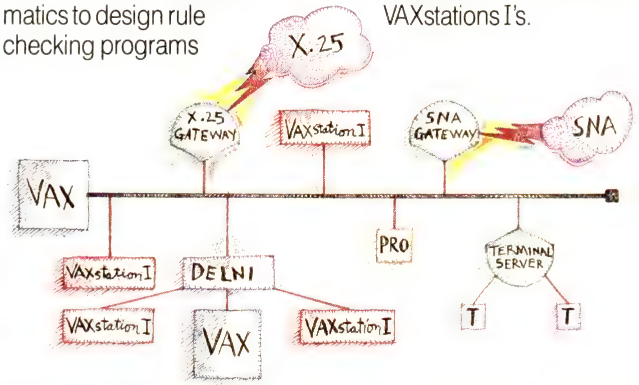

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gle wafer-scale circuit, might yield processors of unprecedented power and cheapness.

At Brunel University, Mike Lea has worked out a wafer-scale architecture based on associative string processors. In these structures, text and data strings can be called up by their content, rather than address.

Associative string processors, says Lea, are extremely flexible; they can be used in image and text processing or in running fifth-generation computer languages. Their regular and simple structures map well onto both conventional and wafer-scale chips. Brunel's Scape image-processor chip is based on this architecture, as is its Script (for Single Chip Relational Information Processing Element), which packs 512 text-processing elements onto a single chip for database management.

WASP flies. Lea's wafer-scale architecture, called WASP (for Wafer Scale Associative Processor) could pack tens of thousands of associative string processors onto a single wafer. His ideas may be taken by a university-industry consortium comprising International Computers, Plessey, Cambridge, and Imperial College. The architecture looks promising for running fifth-generation declarative languages, he says.

At Kings College, Peter E. Osman, an expert on fifth-generation languages, has embarked on a design study for a reduction machine called Cobweb to run Lisp. Osman has designed it so it can easily be integrated onto a single wafer, using a scheme first worked out by Ivor Catt. Kings College is working with Imperial College and GEC's Hirst Research Laboratories, which will be doing much of the two-year simulation and design work associated with the project.

Cobweb, says Osman, is an entirely non-Von-Neumann machine. He sees an array of perhaps 1,000 processors on a chip, each with 2,000 gates. The processors would automatically test themselves and good processors would connect into a long spiraling chain, as in the Catt scheme. But in addition to Catt's spiraling links, there would be radial control lines, thus producing a cobweb of interconnections. Cobweb will likely be funded separately as a study of fifth-generation architectures. ☐

ARTIFICIAL INTELLIGENCE

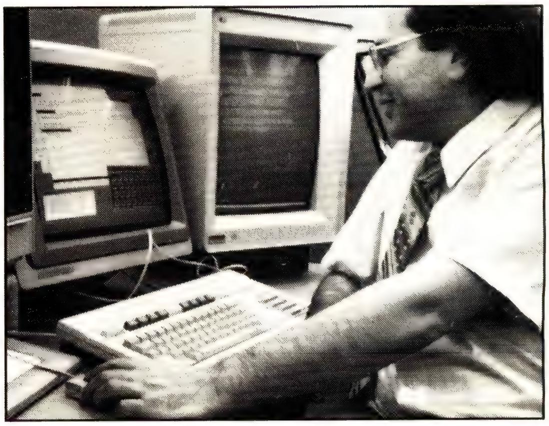
UNIVERSITY GRANT UNVEILS HP AI SYSTEM

Palo Alto

Hewlett-Packard Co. lifted the veil on 3½ years of research in artificial intelligence last week by licensing the results of its work as part of a massive gift for AI education at a number of leading U.S. computer science universities. The firm's AI group, formed at HP Laboratories here in 1981 by Massachusetts Institute of Technology emigré Ira Goldstein, has developed a Unix-based system for creating AI applications.

Over a three-year period, HP will provide equipment and software worth $50 million to MIT and to some half dozen other universities, including Stanford and the University of Texas. The hardware will be high-performance work stations in HP's 9000 series, based on AT&T Bell Laboratories' Unix operating system. The software is the firm's own language environment for creating expert systems, written in Lisp inside the Unix environment.

HP's system, called HPRL (for Heuristic Programming and Representation Language), was developed by a department of about 50 people working under the direction of Goldstein, a former student of AI pioneer Marvin Minsky.



Industrial-strength. Computer scientist Ira Goldstein developed HP's AI system to run on standard hardware.

Goldstein calls HPRL an amalgam of the two basic elements of AI research: the rule-based reasoning systems favored by software firms on the West Coast and the representational languages that are used by companies in the East. The system has been in use for over a year at the various schools that will benefit from the program. The universities will not get the expert systems but rather the HPRL software itself, plus natural-language and symbolic-mathematics software.

Eventually, Goldstein adds, HPRL and some of the applications it has generated will become HP products. He characterizes the Unix-based system as "industrial strength" AI, because it can call subroutines in C, Fortran, and Pascal, and it can be adapted to other Motorola 68000-based machines. HPRL can also run on HP's new portable engineering work station, the Integral Personal Computer [*ElectronicsWeek*, Dec. 10, 1984, p. 78].

HP is testing several applications created from the system. These include expert systems for semiconductor fabrication, troubleshooting, and office automation, and a natural-language data base. Because they run under Unix, these systems can sit on a network like any other user and can perform server functions.

The office-automation application package is an expert system that operates as an office manager. Users can ask it to perform routine tasks, such as ordering supplies or checking information in a data base, much like a departmental secretary. All of the applications can communicate across local-area networks such as the 802.3 LAN that HP will introduce later this year. The troubleshooter, also operational this year, will be used at HP's response centers for diagnosing computer failures. –**Clifford Barney**

JAPANESE AIM TO MAKE BUNDLE WITH SOFTWARE

Los Angeles

The failure of Japanese-developed software products to make substantial inroads in the U.S. market stems more from basic cultural differences than a technology lag. If this view is correct—as most observers believe—prospects look dim for Japanese application packages or operating systems that may soon appear in the U.S. arena.

What hasn't worked in past Japanese efforts in marketing software, analysts say, is the frontal approach, in which the software is either bundled in with Japanese-made microcomputer hardware or sold as separate packages. One approach, however, remains to be tried: coming in the back door by supplying a specific program as a component that is bundled in with a bigger U.S. package.

Taking this new tack is JSE International Inc., a new company formed by parent JSE Group, Tokyo, which specializes in writing software, along with importing existing U.S. packages into Japan and translating them for the Japanese market.

"We want to take software in both directions," says William Smale, executive vice president of JSE International. He earlier held a similar post at JSE Group's Software International subsidiary, which modifies U.S. software and wholesales it to Japanese distribution channels. Among its products: Ashton-Tate's dBase II, the relational data-base system that has captured upward of 75% of the Japanese market for this type of software.

Edge required. For the JSE Japan-to-U.S. plan to succeed, the first offering must have a discernible edge over its competition, and Smale thinks he has the right candidate with dChart, a souped-up graphics package. Already a success in the Japanese market and used with, but not restricted to, dBase, dChart has one outstanding feature, according to the JSE executive.

For variety in the display charts and graphs, the user can create new figures and symbols in a matrix module. In Japan, this feature has gone over in a big way. Moreover, dChart has the generally crisper display and higher resolution that characterizes Japanese graphics—the one segment of software in which the island nation has a clearcut advantage, analysts say.

U.S. views differ. Although the JSE reverse-direction marketing move already is attracting comment within the closely knit U.S. software business, opinions about its potential for success lean toward the skeptical. "It's a difficult strategy, challenging in both directions," observes William Coggshall of Software Access International Inc., a market research and analysis firm. "This segment may be a little crowded already," he adds.

Both Coggshall and Robert M. Lefkowits, an analyst at InfoCorp., point out that the existing cultural gap is still difficult to bridge.

Smale has his supporters, however, at both Ashton-Tate and Digital Research Inc. "It [JSE's plan] is very smart and will work," predicts Ronald Posner, international vice president at Ashton-Tate who has worked closely with the Japanese firm in the past. (His company won't get serious about dChart, however, because of its existing relationships with competing third-party suppliers.)

James A. Tillinghast, acting director of Japanese operations for Digital Research, plays down the cultural barrier confronting JSE. "The great Japanese graphics expertise is really generic in nature, so not concerned with function," he notes.

As a result, JSE can target specific uses with generic tools, without the problems dogging other software types. His firm sees no threat to its business, and Tillinghast, a longtime friend of Smale's, hopes the dChart will be modified to an application package for Digital Research's product, called GEM—graphics environment manager.

In Smale's view, the initial goal is "not to make a big splash, but to prove it's possible to sell successfully into a niche." He expects to announce contracts within weeks, as a result of current negotiations with two kinds of companies: those that sell direct, and those that handle add-on products. JSE has another graphics package—for demographic mapping—ready for the market. The effort is supported by JSE sales growth in Japan, which should be nearly $16 million this year from microcomputer software.–**Larry Waller**

The trials and tribulations of translation

Suppliers seeking to translate English software into Japanese—and vice versa—will soon discover the tasks are far from equal in difficulty. When JSE Group's Software International subsidiary set out to turn Ashton-Tate's popular dBase II into a Japanese package, it took some six months to produce modified coding and translate the documentation. Of all the foreign-language versions of dBase II (there are seven in all), "Japanese was by far the toughest," says Ronald Posner, international vice president at Ashton-Tate.

The challenge in converting software lies in the vast difference between English and the Japanese language's kanji characters. JSE International's executive vice president William Smale explains that for U.S. software, space for only 128 character types is needed. "In Japanese, you must display upwards of 7,200 characters." But there is an advantage in going from Japanese to English, which can be done in the manner of a programming subset, he notes. Turning his firm's dChart package from Japanese to English, for example, was simple, taking far less time than the dBase II modification. Also, the ideographic nature of Japanese characters gives graphics software packages an edge over other non-visual languages. –L.W.

WORKSHARING AVOIDS LAYOFFS

Austin, Texas

A state unemployment act aimed at thwarting widespread layoffs in cyclical industries is gathering the tacit approval of electronics firms facing fickle markets for chips and computer systems. Now law in seven states and under consideration by others, the legislation—known as "worksharing," or short-term compensation—has also garnered the active lobbying muscle of Motorola Inc. here during the biennial session of the Texas legislature.

Worksharing legislation allows more employees to collect jobless benefits whenever work hours are reduced because of economic downturns. The concept, which is getting support in the U.S. Congress, is intended to encourage troubled firms to cut the work hours of all employees rather than to furlough a percentage of their workforces.

Keeping workers happy. With worksharing, a company may elect to cut work schedules by one day a week instead of laying off 20% of its employees. The workers then have the option of applying for one day's worth of unemployment benefits.

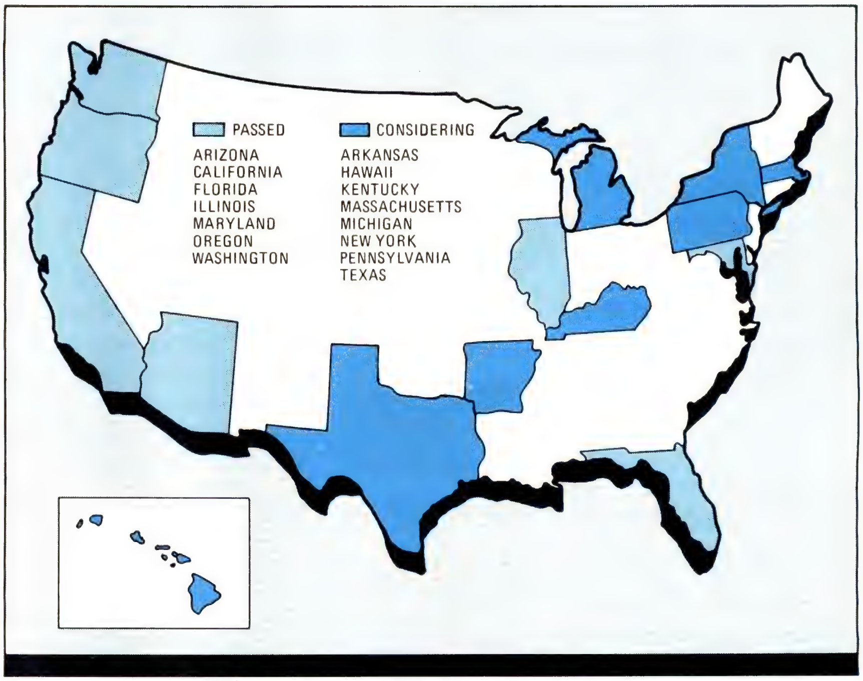
The benefits, plus reduced wages from the employers, often total 85% to 90% of the normal take-home pay, say worksharing proponents. Because other company benefits—such as insurance and vacation time—are retained, employees are more likely to wait out the bad times and stay with a troubled firm, backers of the bill believe.

The bill is getting the quiet support of other electronics manufacturers around the Lone Star State, including Texas Instruments Inc. But none is as vocal in its support as Motorola's MOS operation in the Texas capital city.

An existing worksharing provision in Arizona enabled Motorola's Semiconductor Product Sector to retain hundreds of workers during the 1982 recession. In addition, Motorola estimates it saved millions of dollars in layoff-related expenses, according to testimony by Charles R. Debow, director of employee relations.

The intent of the legislation is to encourage firms to distribute the effects of recessions, says the Texas bill's sponsor, State Rep. Lloyd Criss. "I have come across zero opposition, so far. Both the AFL-CIO and Texas Association of Business have endorsed it, and they are working to have it passed," says Criss, who also serves as a union official for oil-pipeline fitters in Galveston.

However, there are some potential drawbacks to sharing work in recessionary times. Some opponents of the concept caution that top-paid employees might elect to take on full-time jobs with competitors when pay is cut. Too, senior employees suffer as much as those recently hired. Nonetheless, observers believe worksharing acts will help many semiconductor suppliers and computer houses in economic recessions.



Momentum building? Seven more states are currently considering adding the worksharing legislation to their laws, joining the seven states that have already adopted the concept.

"The first question is whether it impacts state trust funds [for unemployment benefits]," notes Bennet Burgoon, a Phoenix, Ariz., consultant who has testified at worksharing hearings across the nation. To date, evidence shows worksharing benefits have had no impact on the solvency of state funds, he adds. Compared to layoffs, worksharing potentially results in additional costs in some areas for employers while saving expenses in others. But in most cases studied, savings have outweighed the additional expenses, Burgoon notes.

Costly in long run. However, officials with the National Foundation for Unemployment Compensation and Workers Compensation organization in Washington worry that worksharing proposals will end up costing state trust funds more money because workers may not be encouraged to seek new *full-time* employment. "We just want to make sure that those companies using worksharing are the ones paying for the additional costs," states Charles Little of the foundation.

In Texas, Criss's bill is now before the state House of Representatives after being unanimously approved by the House Committee on Labor and Employment Relations. During committee hearings, Motorola officials testified in favor of the act, pointing out that it saved about $1,868 at its chip-making plants in Arizona each time the firm was able to carry a production employee during the 1982 recession.

According to a study by Burgoon and Arizona State University, worksharing prevented the layoff of 522 Motorola production workers, saving Motorola more than $975,000 in its chip-manufacturing operations alone.

Motorola also realized economies in other employment areas that were placed under the reduced-work schedule. According to initial estimates, the firm saved a total of $2.4 million in 1982. Worksharing helped Motorola avoid a repeat of the massive layoffs of 1974 and 1975, when 9,000 workers were furloughed in Arizona.

Cost considerations. Worksharing savings are based on overhead expenses usually associated with laying off workers plus the cost of rehiring and training employees when business improves. In addition, wage expenses are generally lower in worksharing because layoffs usually involve only recently hired, lower-paid workers. Worksharing, furthermore, trims all paychecks, including top-paid employees.

Then when the economy picks up, the biggest savings come from lower rehiring and training expenses. All these savings are offset somewhat, however, because fringe-benefit costs and payroll expenses are generally higher under worksharing because all workers are still employed, according to Burgoon.

Under the Texas bill, workers may apply for worksharing benefits when hours are cut between 10% to 40%. Present state law allows workers to collect partial benefits, but they must also seek a new job.

Worksharing was first passed by California in 1978. Bills were later adopted by Oregon and Arizona, then Illinois, Florida, Washington, and Maryland. Today, worksharing is being considered by Arkansas, Hawaii, Kentucky, Massachusetts, Michigan, New York, and Pennsylvania. Worksharing programs also exist in Japan and Europe, notes Criss, adding that Canada is now studying the results of a nationwide pilot program. **–J. Robert Lineback**

SOFTWARE MARKETING

AT&T REACHES OUT TO PROGRAMMERS

New York

Combining a solid base of Unix users and its ample telecommunications expertise, AT&T Co. has launched an experimental project designed to deliver Unix System V programming tools over telephone lines.

The project, called the Unix System Tool Chest, consists of 13 programming tools developed and used internally by AT&T, according to Cathi Brooks, supervisor of AT&T's Internal Applications Acquisition Group in Summit, N.J. "We've had over 130 different programmers browsing through the tool kit since Jan. 2," she says.

In the initial phase, programmers such as source-code licensees or sublicensees have been given a telephone number that allows them to browse free of charge through the packages. Once a tool is selected, AT&T will deliver source code and documentation to the user by means of a 1,200-baud modem. Fees for source code range from $100 to $2,000.

Robust market. "The most robust part of the market is the one for this product," explains Unix market analyst Jean Yates of Yates Ventures. She estimates that there are currently 80,000 Unix users and notes that "those users are prime targets for this product."

Other software developers have tried to distribute applications software electronically; Unimart Corp., for instance, is currently doing so with Unix applications software. But analysts believe AT&T's effort may be the first attempt to deliver programmer software tools over telephone lines.

"It's about time," says Ray Jones, president of Onager Publishing. "Compatibility of medium is a horrible problem." If AT&T can surmount these problems, he continues, "There's a tremendous market potential for electronic distribution."

According to AT&T's Brooks, development of the tool kit project began last April. Currently, AT&T has only four telephone lines into one of its 3B2 minicomputers. But eventually, she says, the system will convert to AT&T's 32-bit 3B5 minicomputer.

The tool catalog will be updated for the first time in the next several weeks, Brooks adds, with periodic updates to follow. Source code for the programming tools will be in the C programming language. Hence programmers need only a C compiler and the Unix-to-Unix copy program, widely available with Unix System V, to handle file transfers.

This will be the first attempt to deliver software tools to programmers over telephone lines, AT&T officials believe.

The AT&T project is "quite significant, because programmer software changes faster than any other," explains Brian Boyle, a Unix market analyst with the Novon Research Group. With an installed base of 350,000 Unix sites projected by the end of the year, including some 100,000 sites that could be candidates for the Unix tool chest, Boyle estimates AT&T could eventually attract between 8,000 and 10,000 programmers.

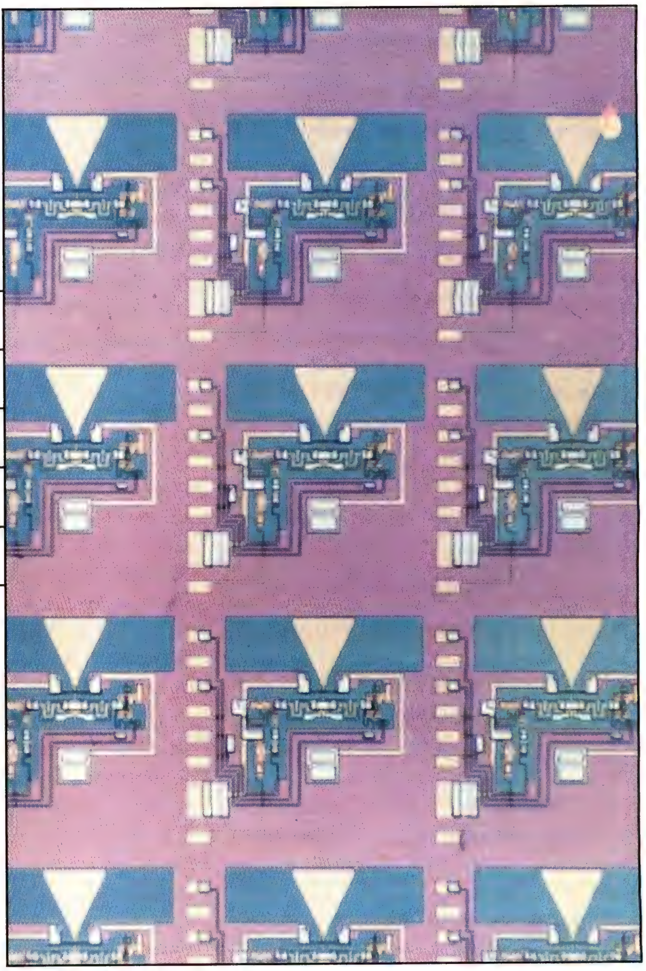
Big gap. Citing the recent withdrawal of a Unix applications library, Boyle cautions, "It's not too dramatic to say that they [AT&T] don't fully realize how big the gap is between the program and the product."

"There are a lot of people watching the project to see how well it works," concedes Brooks. AT&T will evaluate the programmer response during the third quarter of this year before determining the size of its commitment. **–George Leopold**

JJs ON AN UPSWING

Josephson junction technology still has plenty of life left as a variety of labs work toward a commercial payoff

☐ *by Wesley R. Iversen*



Good start. A dense array of superconducting circuits is on one of the chips fabricated by Hypres Inc. It uses a six-layer process and 2.5-μm line width that integrates 10 to 15 Josephson junctions.

Chicago

Like the carrot before the horse, superconductive electronics has long been a lure that has kept researchers stretching toward the promise of a commercial payoff for successfully developing the technology. But so far, the reward has proved elusive.

Early generations of superconducting Josephson junction circuits based on lead alloys were relatively easy to fabricate in the laboratory. But among other drawbacks, they were found to be unable to withstand repeated cyclings between room temperature and the 4-K temperatures needed for operation.

"If academia had moved ahead in a more robust materials technology 10 or 15 years ago when this technology started, today we might have more devices in the field," laments Raymond J. Schneider Jr., technical director for Josephson junction devices at Sperry Corp.'s Defense Products Group.

The technology has also been hindered by the requirement for cryogenic cooling, an expensive and bothersome method. For digital logic applications, constraints imposed by the two-terminal configuration of the basic Josephson junction has also slowed efforts in developing superconducting integrated circuits.

The most notable setback for the technology came 18 months ago, when IBM Corp. gave up on its efforts to develop a superconducting mainframe computer based on Josephson devices. Involving some 115 researchers and an estimated $20 million annual spending level near the end, the IBM push represented nearly half of the total U.S. effort in superconductive electronics research at the time, and termination of the project by the computer giant dealt a major psychological blow to U.S. research efforts in the field.

Japanese persevere. The IBM move also worries some within the Defense Department, since the decision leaves the U.S. without a facility capable of fabricating large-scale superconducting logic circuits at the 100-plus-gates level. By contrast, several such facilities exist in Japan, where researchers are pushing ahead strongly with efforts to develop superconductive chips for potential 1990s supercomputer applications [see "Japan superconducts JJ development," p. 31].

"As far as a large-scale digital mainframe [using superconductive circuits], if it's going to be done, it will be the Japanese who do it," predicts Clark A. Hamilton, a researcher in the Cryoelectronics Group at the National Bureau of Standards. Such a development "would require a huge dedicated effort, on the order of $20 million per year," Hamilton observes. He adds that within the U.S. industrial community, "I don't think there's that kind of money around."

Neither does near-term help appear likely from the DOD. One of the recommendations from a task-force study last year, sponsored by the Naval Studies Board and others, was to set up a central fabrication facility with DOD funding that could be used by all U.S. researchers for development of large-scale Josephson-based circuits. Such a facility "would meet both a DOD and a national need," the report says.

The study estimated costs at about $2 million initially, with an additional $1 million to $1.5 million per year required to support the facility. Although the idea still has its backers, particularly within the Navy, such a facility would require hard-to-get cross-agency support and, says one Navy official, appears unlikely to be funded—at least this year.

Faster and leaner. But despite the gloom in some camps, there are indications that superconductive electronics may finally be moving toward wider commercial and military use. The appeal of the technology is obvious. For digital logic applications, cryogenically cooled Josephson-based circuits offer switching speeds that are potentially two to six times faster than the best semiconductors, while operating at power levels two to three orders of magnitude lower.

One firm hoping to cash in is startup Hypres Inc. Founded by former IBM Corp. researchers who worked on the superconducting mainframe project, the two-year-old company has obtained licenses from IBM and is the first to announce plans to sell systems commercially based on superconductive ICs.

Staked with $2.3 million in first-round financing, Hypres has already fabricated chips using a six-layer process and 2.5-μm line width that integrates 10 to 15 Josephson junctions. The firm ultimately can move to circuits containing hundreds of devices, according to president and chief executive officer Sadeg M. Faris.

In line with the current mainstream in Josephson research, Hypres is working with niobium and niobium nitride, refractory materials that are harder to handle but that produce junctions that are much more mechanically robust than lead. During the latter stages of the IBM project, the computer giant switched to a Josephson process that used niobium for one of the two superconducting electrodes, but maintained lead-based material for the other.

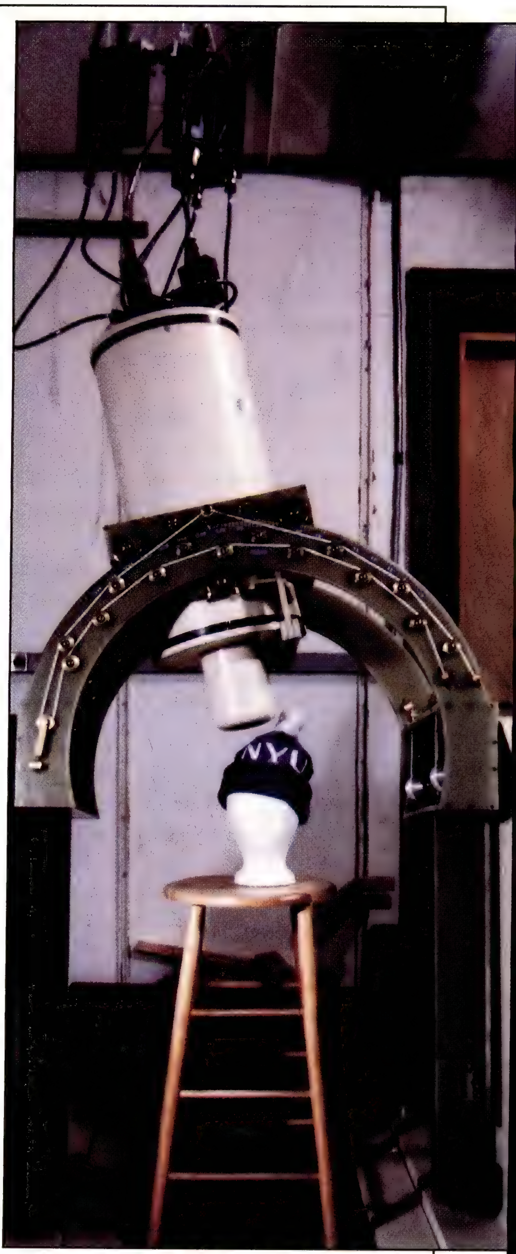
"We have solved the problems that IBM had with its own proprietary process," Faris declares. The Hypres president says that first commercial products will be introduced around year end and will offer "performance advantages for high-speed signal-processing applications that are at least five times better than what's available today." Hypres officials won't provide product details, noting only that the initial Josephson-based equipment will be aimed at test and measurement markets.

Only way to go. Even if superconductive electronics never pans out for computer applications, most researchers believe that the technology will find at least limited applications elsewhere. Despite the disadvantage of the cryogenic cooling requirement compared to conventional electronic devices, "there still are a number of special applications where superconductivity offers such a great performance advantage that it's the only way to go," contends Hamilton of the National Bureau of Standards.

Besides the potential advantages promised by superconductive electronics for digital circuit applications, the technology also holds plenty of appeal for a number of noncomputer jobs that do not require large-scale-integration capabilities. Magnetometers and gradiometers built from superconductive devices, for example, offer near-ultimate sensitivity limited only by quantum-mechanical effects. Other characteristics of superconductive technology include extreme stability, potential for the lowest noise levels of any circuit type, and the possibility of nearly lossless transmission lines for use in circuits and electronic subsystems.

One firm banking on superconductivity is Biomagnetic Technologies Inc. Formerly known as S.H.E. Corp., the firm has been making and selling Squids (superconducting quantum interference devices) and Squid-based systems commercially for a variety of niche applications since 1970, but it recently changed its name to reflect what the firm hopes will become a booming medical-applications market for Squid-based instrumentation [*Electronics*, Nov. 3, 1982, p. 47].

In particular, Biomagnetic Technologies is focusing on magnetoencephalography (MEG). The technique has "revolutionary implications for diagnosing illnesses associated with the functioning of the brain," says William C. Black Jr., vice president for operations.



Say aah. A prototype five-channel Squid-based neuromagnetometer by Biomagnetic Technologies Inc. undergoes tests at New York University Medical Center.

Unlike certain more widely used electroencephalogram techniques, which require the implantation of electrodes inside the cerebral cortex for measuring electrical signals, MEG measures the minute magnetic fields associated with those signals in a noninvasive manner. What's more, MEG can be used to pinpoint the location of neural firings, something that EEGs cannot do.

One spur to the MEG market is expected to come from development of the dc Squid. Biomagnetic Technologies sold early versions of the product beginning in 1981. Previous-generation rf Squids—which the firm also supplies—are single-junction devices in which signals are read out by a radio-frequency carrier that is modulated by the flux state in the Squid.

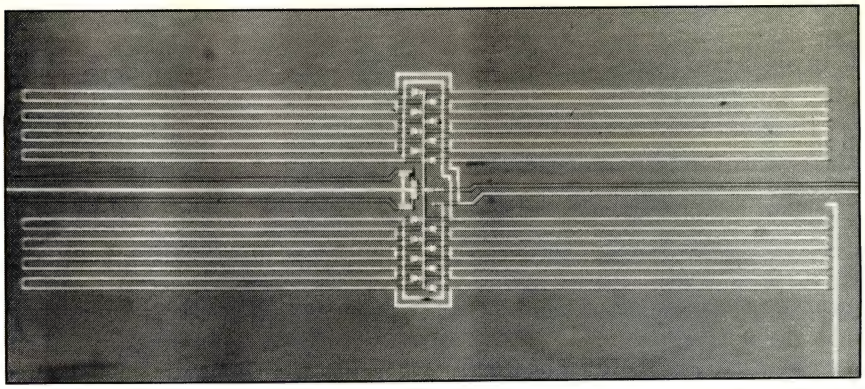
By contrast, the dc Squid incorporates two Josephson junctions in the superconducting loop and relies on the fact that a Josephson junction develops superconducting ac at gigahertz frequencies when a small dc voltage is applied across it. In part because the dc Squid operates at much higher frequencies than the 20- to 30-MHz levels of the rf Squid, the result is lower noise and consequent sensitivity levels that are 10 times better than the earlier version.

Magnetic fields generated in the brain can range from several hundred femtotesla to as low as 20 fT, says Black. This is out of the range of rf Squids, which have sensitivity levels down to about 50 fT, he explains. By contrast, the 5-fT sensitivities exhibited by the dc Squid puts the entire range of minute brain signals well within its reach, Black points out.

Brain food. This month, Biomagnetic Technologies announced a collaborative research program with the New York University Medical Center to adapt the technology for the clinical environment. The firm has been working informally with NYU for the past five years, and last year delivered a prototype five-channel dc Squid-based neuromagnetometer to the school for use in MEG application research (see photo).

That system relies on a thin-film process to fabricate the five-element Squid array using niobium junctions with an amorphous silicon barrier. Though Biomagnetic Technologies currently couples the array to external detection coils that pick up the magnetic signals, future development may allow the Squids and the coil function elements to be laid down on the same monolithic device.

Under terms of the three-year collaborative agreement—by which NYU will provide funding with Biomagnetic Technologies kicking in equipment and staff support—the company will deliver two seven-channel systems to the school this summer. When used in tandem, these systems will permit simultaneous read-out of electrical activity from 14 different brain sites, thus reducing the time needed to scan the brain regions of interest.



Exposed. This fully monolithic thin-film Squid by Sperry operates without shielding in the Earth's magnetic field. Squids of conventional design must use a superconducting enclosure.

Plans call for the development within about two years of a 100-channel system sufficient to completely encircle the head with a close-spaced grid. In the meantime, the firm plans to offer the seven-channel system at a price of about $375,000, including external noise-canceling electronics, a subject platform and positioning device, and a Masscomp MCS 531 computer supplied by Massachusetts Computer Corp. for data processing.

Superconductive electronics holds plenty of allure for a number of noncomputer jobs not requiring LSI.

Despite the fact that his company has sold fewer than 1,000 Squids and systems and has never recorded annual revenues of more than $5 million in its 15-year history, Black believes that MEG could put the company on a fast growth track toward annual sales approaching $100 million within five years. "If MEG is adopted, every major hospital will need this kind of equipment," he contends.

That demand will produce a total available market in the $1 billion range, he guesses. A number of major medical diagnostic companies are said to be working on the technology, including the West German firms Siemens AG and Dornier GmbH, although neither will confirm the fact.

On the military side, U.S. Navy officials are also looking at superconductive electronics for a number of future applications. These include submarine detection and location, extremely-low-frequen-cy underwater communication, millimeter-wave and infrared imaging systems, millimeter-wave broadband communication and radar systems, and signal processors. Navy funding of superconductive electronics research totaled nearly $5 million during fiscal year 1984, compared to $2.5 million by the Air Force and zero for the Army, which effectively dropped out of the field in the mid-1970s.

Antisub effort. One of the nearest-term Navy applications could be in an antisubmarine-warfare research effort known as Madair (for magnetic anomoly detection and identification plus ranging). Initial airborne and seaborne platform field tests were completed under the program last year deploying experimental superconducting gradiometers said to be 100 to 1,000 times more sensitive than conventional magnetic-detection devices. Supplied by Sperry, the experimental five-element units are based on Squids built with niobium-amorphous silicon-niobium junctions.

The Madair system is designed to go beyond current-generation fielded MAD (magnetic anomoly detection) systems by not only detecting but also locating and perhaps determining the size of a target, says Gary J. Kekelis, a branch head at the Naval Coastal Systems Center. Not only did the Squid-based system perform up to expectations during field tests, but it also proved to be very rugged, enduring more than 100 temperature cyclings over a three-year period with only one failure, Kekelis notes.

The center will begin a three-year

program in October to develop software to make the system more user-friendly and to improve the system's refrigeration system. "We'll have to reduce the need for liquid helium as much as possible in order to sell it to the fleet," Kekelis observes. If objectives are met, Madair could be moved from research to a development project by 1988, he says.

Cold problems. Current options for cryogenic cooling systems capable of 4-K operation include thermos-bottle-like open-cycle dewar systems and closed-cycle refrigeration units. There are disadvantages to both schemes: dewars must be frequently replenished, while refrigeration systems are expensive and complex, with reliability problems caused by the need for moving parts. As a result, the Navy, among others, is funding a number of programs aimed at improved cryogenic systems.

A related effort drawing considerable research attention involves the development of superconducting junctions based on materials that do not require liquid-helium temperatures for operation. The front-runner for those honors is niobium nitride, which becomes superconductive at about 14 K to 16 K.

Because of its higher transition temperature compared to lead or pure niobium—which go critical at about 7 K and 9 K, respectively—niobium nitride-based systems could get by with 10-K refrigeration systems. This could lead to improved reliability, lower cost and power, and increased miniaturization of closed-cycle cooling systems by eliminating one level of refrigeration complexity.

As noted by Richard D. Blaugher, manager of the Cryogenic Technology and Electronics Department at the Westinghouse Research Development Center, "It's a lot harder to go from 10 K to 4 K than it is to get down to 10 K. Anything we can do to relax the refrigeration problem will help."

Among other efforts, Westinghouse is currently studying so-called A15 alloys under Air Force and Navy contract for potential use in superconductive devices. Included in that group is niobium germanium, which, at 23 K, exhibits the highest superconductive transition temperature yet observed for any metal, alloy, or compound. ☐

Japan superconducts JJ development

When it comes to developing superconductive digital integrated circuits for potential computer applications, the accomplishments of Japanese researchers dwarf those of others currently working in the field. As a U.S. government task force report on the topic last year noted, the Japanese have devised several superconducting logic families, set new records for logic-circuit speed, developed both lead-alloy and niobium-based fabrication technologies, and demonstrated large-scale integrated logic and memory circuits. Only IBM Corp., which has shut down its superconductive mainframe effort, can boast of comparable achievements [*Electronics*, Feb. 10, 1982, p. 38].

One of the latest examples of Japanese prowess came at the recent International Solid State Circuits Conference in New York, where NEC Corp. reported on a 4-by-4 multiplier that relies on 850 Josephson junctions configured as 250 gates. Featuring an execution time of 280 ps, the multiplier achieves speeds that are some 14 times quicker than the fastest comparable gallium arsenide circuit yet reported, researchers say.

Extremely fast memory circuits have also been produced. The Atsugi Electrical Communication Laboratory of Nippon Telegraph & Telephone Public Corp., for example, has reported on a 1-K lead-based Josephson memory chip that exhibits a 3.3-ns access time, with gate delays of 4.2 ps, among the fastest in the world.

NTT has an estimated equivalent of 40 full-time researchers working in the field in an effort that is completely separate from the supercomputer program sponsored by Japan's Ministry of International Trade and Industry. An additional 40 researchers are believed involved in the latter program at NEC, Hitachi, Fujitsu, and at the government's Electrotechnical Laboratory. The eight-year supercomputer project is reportedly funded at between $100 and $150 million and is examining several technologies including conventional silicon, high-electron-mobility transistors, and Josephson junctions. According to Hisao Hayakawa, chief of the laboratory's Fundamental Science Section, a decision on which technology to use for the project will be made by the end of the first quarter of next year.

Though much early Japanese work has involved use of lead-based junctions, the emphasis is shifting to refractory materials. The Electrotechnical Laboratory is concentrating on niobium and niobium nitride junctions, and has current goals of producing 1-K and 16-K memories with access times of 300 ps and less than several nanoseconds, respectively. NEC is also working with pure niobium, which it currently prefers to niobium nitride because pure materials are easier to oxidize during the fabrication process. If the laboratory has success with niobium nitride, however, NEC researchers say they will likely go that route.

Even if Josephson junctions don't make the cut for the supercomputer project, Japanese researchers stress that work in the technology is aimed at the long term and will probably be continued. This is in contrast to the previous IBM effort, which appeared to be aimed at producing a superconductive-based computer by 1986, points out Kazuo Ayaki, who is general manager at the Microelectronics Research Laboratories of NEC Corp.

At the time that IBM terminated its effort in September 1983, the firm said that a probable two-year delay in developing a high-speed 4-K cache memory chip would put the project too far behind schedule against rapidly advancing conventional chip technologies. For a twofold-to-threefold performance edge over conventional machines, instead of the fivefold-to-sixfold advantage originally envisioned, IBM decided the effort to develop a Josephson-based computer was not worth continuing.

But IBM is working on a three-terminal Josephson chip that could be useful in future computer applications, says Alex P. Malozemoff, manager for magentism and superconductivity at IBM's Thomas J. Watson Research Center. Hitachi has already built a highly experimental three-terminal superconducting chip in silicon. **–W.R.I.**

NEC NEWSCOPE

V-SERIES CMOS MICROPROCESSORS

NEC has unveiled the V-Series, a superior species of 16/32-bit CMOS microprocessors.

Ready for your evaluation are V20 and V30 16-bit microprocessors. The V20 has an 8-bit external bus, while the V30 is a full 16-bit machine. A powerful set of 101 instructions, dual data bus architecture and many other design refinements make these chips 50% faster than our 16-bit NMOS processors. Also power consumption is reduced by 70%.

The V20/V30 are supported by a full range of CMOS peripherals. A CMOS coprocessor (Floating Point Processor) is under development. The software package includes a proprietary real time OS, and development tools include an in-circuit emulator, relocatable assembler, Pascal and C compilers.

Shortly, peripherals hop on board. The V40 and V50 feature basic peripheral functions integrated on V20 and V30 silicon. The V25, complete with ROM, RAM, I/O port and serial interface, is a powerful processor for portable products.

The V20~V50 give you higher performance utilizing current software developed for our NMOS micros.

The V60 and V70 are 32-bit microprocessors with mainframe power. Features include an on-chip memory management unit and 4.3-gigabyte virtual memory.

The V-Series is second-sourced by Zilog, Inc.

C&C
Computers and Communications

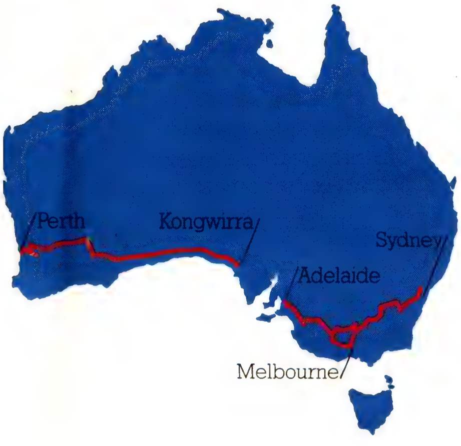
NUMBER 132

LARGE DIGITAL MICROWAVE LINK TO AUSTRALIA

NEC will supply Australia with a third large-capacity digital microwave system. Based on NEC's advanced 500-Series, it will span a total distance of 2,000km between Perth and Kongwirra in 52 hops.

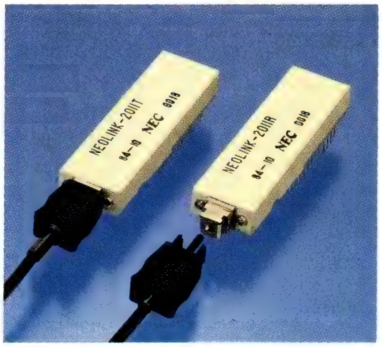
This new link will use NEC's 6.7GHz 140MB equipment with a capacity of 3,840 telephone channels, currently the largest available. The equipment is specially designed to operate in high temperatures, which top 55°C in the desert regions during the summer. Numerous advanced features, including adaptive and transversal equalizers and hitless switchover equipment, are incorporated to assure high speech quality.

The two previously supplied digital links are the 800km Sydney-Melbourne system and 650km Melbourne-Adelaide system. These also feature NEC's 500-Series 140MB equipment and accommodate 11,520 telephone channels.



NEOLINK™-2011 FOR HIGH-SPEED FIBER OPTIC LANs

Our new NEOLINK-2011, a pair of optical transmitter and receiver modules, enables the cost-efficient formation of reliable high-speed LANs without using LDs and APDs.



The NEOLINK-2011 combines a 1.3μm high-speed LED and PIN-PD. This ideal configuration takes maximum advantage of the low-loss, low-dispersion regions of graded index fibers.

The surface-emitting LED features 1.8ns rise and fall times and requires no thermoelectric cooling device. A newly-developed monolithic IC in the receiver incorporates AGC and line failure detection circuits and secures a 15 dB dynamic range. As a result, dependable high-speed digital transmission of up to 200Mb/s over a maximum distance of 3km is possible.

NEC's NEOLINK-2011 mates with graded index fibers of diverse core diameters. Interfacing with other systems is made easy by ECL level input/output and minimal restrictions on data formats.

The 9.5mm-high DIP design can be mounted directly on PC boards and runs on a –5.2V DC power supply. The built-in AGC eliminates circuit adjustments. A low-profile, low-loss connector, with vibration-resistant lock, provides convenient snap-on connection.

NEC also supplies optical switches, couplers, fibers and all other components for LAN systems.

NEOLINK is a trademark of NEC Corporation.

THAILAND SELECTS MORE NEAX61 DIGITAL SWITCHING SYSTEMS

The Telephone Organization of Thailand (TOT) has again chosen the NEAX61 digital switching system. This time as the core of its fifth five-year telecommunications expansion project.

The contracts involve more than 870,000 subscriber lines (except for tandem switches) to expand the present digital network with new exchanges, including remote and cabin switches. When these new exchanges begin service, over two million subscriber lines will be served by NEC systems in Thailand.

The digital telephone network in Thailand features NCOM—NEC's Computerized Operation and Maintenance System. Incorporating the best of NEC's long experience and integrated computers and communications (C & C) technologies, NCOM provides comprehensive support using computers for the digital network—an important step towards the goal of ISDN.

NEC
NEC Corporation
Tokyo, Japan

FARM AUTOMATION PLOWS AHEAD

Chicago

Pickers in the Florida citrus groves now get over $10 an hour. While this is barely a living wage for an American with a family, it is substantially higher than wages in such places as Brazil, which makes it hard for U.S. growers to compete without automation.

In response, both family farmers and the feedlots of agribusiness have started to turn farming into a labor-thrifty machine-intensive enterprise with an appetite for electronic products. For the first time, agricultural robots and automated inspection systems are being considered as workable solutions to the age-old problem of getting food to the table [*ElectronicsWeek,* Aug. 20, 1984, p. 30].

Today, the criteria for selecting agricultural production techniques are being broadened by automation.

The world's first agricultural automation conference, Agrimation 1, will be held here Feb. 25-28 to address itself to the shape of agriculture to come, as well as to examine the kinds of automation equipment now available to farmers. "Significant gains in future productivity and food availability and quality will come from computer programming and development of sensors," says Sylvan H. Wittwer, one of the conference leaders and director emeritus of the agricultural experiment station at Michigan State University.

According to Wittwer, "this will involve the entire food system—from production through harvesting, processing, packaging, and marketing." He sees the most *important* increases in agriculture as coming not from bringing more land under cultivation, but from growing additional crops during the year on the same land. "The major requirement will be for appropriate sensors of environmental variables and computer programming of growth-factor inputs," he says. In other words, it will require automation.

Combining resources. One of the oldest uses for automation in agriculture is in self-propelled combines. The automation components are supplied either by the combine manufacturer or, more commonly, by the automation manufacturers who sell to them. Since most of the automation equipment is electrohydraulic, the component suppliers tend to be firms with experience in electronics and hydraulics, such as John Dickey Corp. and TRW Inc.

According to John K. Schueller of Texas A&M University's department of agricultural engineering, in College Station, the standard automated item on self-propelled combines is a header-height control. "With the high potential losses associated with improper adjustment during soybean harvest, the availability of this control has become a necessity for all North American combine manufacturers," he says.

The ultimate goal is to avoid damaging a growing crop by measuring how high above the ground a combine's blades are as it moves across a field. This is accomplished with ultrasonic or mechanical sensors that regulate the flow of hydraulic oil to and from the header lift cylinders through a feedback mechanism similar to the governor on an electric motor. The connection between the sensor and the actuator may be mechanical or electrical in this simple system, and no computing power is required to make it work.

Automatic steering. A more complex use of combine automation involves automatic steering. However, many agricultural engineers are skeptical that it will soon reach the market in economically significant numbers. As Schueller points out, "Despite a large amount of research in the area, there is only one manufacturer [Claas Inc.] that produces a steering controller."

That system, which is used only on corn heads, employs two mechanical feelers to determine row-following error. An error signal causes a valve to correct the steering direction. Engineers at the University of Saskatchewan in Regina are reported to be working on applying modern vision systems to guide combines, but no combine manufacturer has yet indicated an interest in using them in its machines.

"About half the foodstuff of the earth is transplanted in some form or another before it is harvested," notes Wittwer. And he expects *this* percentage to increase as the techniques of microbiological manipulation—cloning and embryonic implantation—are applied to a wider range of both plant and animal tissue cultures. "The challenge is for automation of tissue-culture practices . . . including computer-programmed production units," Wittwer says.

Labor costs are high for agribusiness and small farmers alike. Automation will be a boon to both.

What are now needed, according to agricultural researchers, are sensors to detect favorable soil conditions for plant cultures and the progress of ovulation for artificially inseminating livestock. Similarly, the same vision systems that guide tractors and combines can be applied to tissue-culture transplantation when used to direct the motion of pick-and-place robots. When also outfitted with tactile sensors, such robots manipulate delicate tissue cultures more efficiently than a human could.

When it can be *sold* cheaply enough, this sensory sophistication could be a boon to small farmers because it will permit them to raise specialized crops for limited markets, such as kiwi fruit for Silicon Valley, without a disproportionately large labor investment. –**David M. Weber**

OSI RAINS ON IBM'S PARADE

In a move to dilute IBM's dominance, the 10 EC governments intend to make OSI standard mandatory for their procurement

☐ *by Robert T. Gallagher*

Brussels

In a last-ditch effort to bolster the fortunes of their beleaguered native computer manufacturers, member governments of the European Communities (EC) will move decisively before the end of this year to close as much as one third of the European data-processing market to equipment that does not conform to open-systems interconnection (OSI) norms.

Each of the 10 EC countries, *ElectronicsWeek* has learned from government and industry sources who asked not to be identified, will move independently to adopt OSI architecture as a national standard. Soon thereafter, each country will then rewrite its procurement policies to make OSI compatibility mandatory for all purchases by government and related agencies.

Loosening the noose. The move to embrace the architecture is a thinly veiled attempt to loosen the stranglehold that IBM Corp. maintains on more than half the European computer market. By going to OSI, European computer makers hope to stifle the U. S. giant's attempt to establish its proprietary Systems Network Architecture (SNA) in Europe as a de facto, though unofficial, standard. OSI is fostered by both the International Telegraph and Telephone Consultative Committee (CCITT) in Geneva and the International Organization for Standardization (ISO) in Washington for interfacing data-processing and telecommunications systems.

Providing the framework for the national standards is the adoption throughout last year by the EC's Council of Ministers of the seven-layer OSI architecture, layer by layer, as an EC standard. The member countries have now in turn started their internal governmental machinery to implement the standards.

French government sources, for example, say privately that France will probably adopt a blanket clause specifying OSI compatibility for procurements. The UK is more likely to gradually add specifications to its policies as OSI-based products become available. The other EC member governments intend to implement parallel programs. Such unanimity in implementing data-communications policy is without precedent among EC countries.

The watershed in

Parisian façade. IBM's headquarters in the Place Vendôme, near the Hotel Ritz in Paris, reflects the firm's prosperous position in Europe.

the affair was last summer's settlement of an unfair practices suit between the U.S. company and the EC Commission whereby IBM agreed to significantly speed up its publication of new product interface specifications [*ElectronicsWeek,* Aug. 13, 1984, p. 20]. Though the concessions were the most sweeping that IBM had ever agreed to, most European officials have been vocal in charging that they were of insufficient consequence to reduce IBM's market dominance.

Even before the Brussels settlement, the stage had been set for European support of the standard when 12 principal European data-processing equipment manufacturers had already signed a pact calling for the production of OSI-compatible equipment [*Electronics,* March 22, 1984, p. 63]. Since then, their governments have fallen into line.

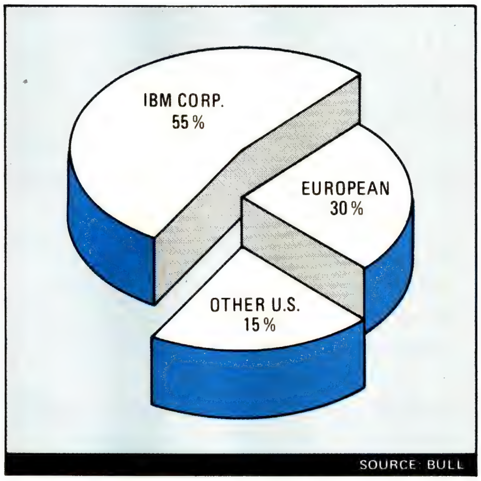
Typical of the attitude of officials of EC member governments is that of Jacques Dondoux, France's Directeur Général des Télécommunications, who says, "It is our intention to have open public networks with internationally normalized interfaces as a means of avoiding any appropriation of networks, whether it be by a [data-processing] equipment manufacturer or by a closed group of users."

One for all. Henri-Alain Combet, deputy director of industrial programs in data processing and office automation at the French PTT Ministry's Direction des Affaires Industrielles et Internationales, explains that, in concrete terms, Dondoux's proclamation means that "We [EC countries] have agreed on a European standard, and that standard is OSI. Consequently, this European standard then becomes individual national standards and all orders for public procurement must conform to them."

Similarly, an official at the West German industry ministry revealed that the Bonn government will demand that its agencies buy only such data-processing equipment as conforms to OSI standards. "This will be written into future procurement policies," the official confirms.

In France, government orders make up just over half of the national market, with the European average being closer to 30%. The bottom line here is that IBM, unless it wishes to forgo competition for a substantial piece of the European market, will have no alternative but to offer some means of communication between its SNA-based products and an OSI environment. That will present little, if any, technical difficulty, but it will force IBM out of its traditional strategy of offering only closed, proprietary systems.

Most observers expect IBM to respond by offering gateways between SNA and OSI, implemented either by means of a black box or integrated software. Because IBM furnishes systems to countless customers with both U.S. and European operations, it is hard to see how it could limit such an offering to Europe.



SOURCE: BULL

Big slice. European computer makers are counting on OSI to help whittle down IBM's market share.

Though IBM publicly supports the idea of international standards, and OSI in particular, most of IBM's competitors accuse it of dragging its feet in helping define and implement OSI specifications. They point out that IBM has worked indefatigably, through proposals for joint ventures and common projects, to get SNA established in Europe as a de facto industry standard. It is now clear that the strategy has failed, with the death blow dealt by the UK's Tory government, which blocked a proposed IBM-British Telecom joint venture to create a national value-added network based on SNA.

Following the EC countries' adoption of OSI, one significant problem will remain: no products compatible with the norm are as yet available on the market. Most European manufacturers, however, expect to begin deliveries of OSI-based equipment this year and predict they will grow in volume as the uppermost layers of the seven-layer standard are finalized over the next two years. Robb Wilmot, chief executive of International Computers Ltd., is looking for OSI terminals to take at least half the world market by the beginning of the next decade.

Short on time. Jacques Stern, one of the driving forces behind the European accord on OSI and chief executive officer of Bull, the leading French data-processing equipment manufacturer, reckons that the manufacturers have no more than two years to get a critical mass of products into their catalogs before the window of opportunity will have passed. The barometer of their success will be what happens to IBM's European market share, currently estimated by its competitors at approximately 55%.

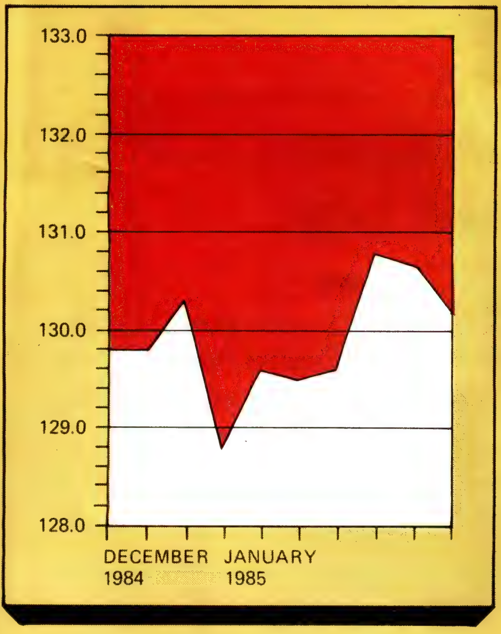
The notion of using international standards to pry away a piece of IBM's market share hasn't escaped data-processing equipment manufacturers on the other side of the Atlantic. There is a general consensus that U.S. manufacturers will begin shipping at least some OSI-compatible products by 1986.

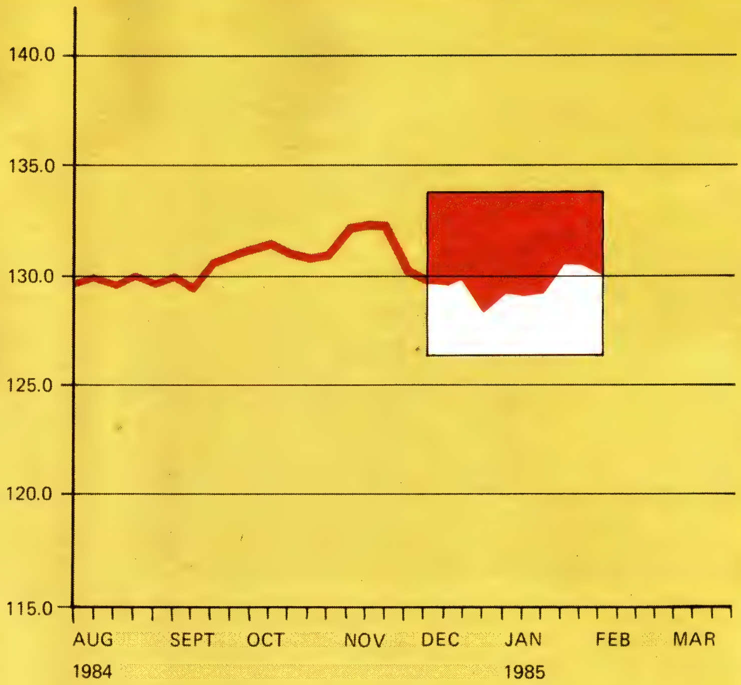
Unlike European firms, who are counting on strong government support for the OSI effort, U.S. manufacturers believe that most of the impetus will come from market forces. Already, they say, customers are demanding multivendor solutions for future networks.

That is not to say, however, that the U.S. government is not interested in OSI. Kala Marietta, manager of global systems engineering for Honeywell Information Systems, points out that the National Bureau of Standards intends to publish the ISO standard as a Federal Information Processing Standard (FIPS).

This means that at least some large federal procurements in the future will require OSI standards, probably beginning some time in 1986. More support for OSI is expected to come from the manufacturing-automation protocols (MAP) being vigorously supported by General Motors Corp. [*ElectronicsWeek,* Dec. 17, 1984, p. 20]. These protocols are almost exclusively OSI. ☐

ElectronicsWeek Index





THIS WEEK = 130.2
LAST WEEK = 130.7
YEAR AGO = 121.8
1982 = 100.0

The *ElectronicsWeek* Index, a seasonally adjusted measure of the U.S. electronics industry's health, is a weighted average of various indicators. Different indicators will appear from week to week.

U.S. ELECTRONICS COMPONENTS PRODUCER PRICE INDEX (1967 = 100)

	January 1985	December 1984	January 1984
Digital bipolar integrated circuits	60.3	62.1	63.6
Digital MOS ICs	42.1	42.6	46.2
Linear ICs	59.9	64.3	63.1
Capacitors	192.5	191.9	191.8
Resistors	186.4	186.4	179.4
Relays	319.3	319.3	303.0
Connectors	232.4	232.8	224.9

U.S. GENERAL ECONOMIC INDICATORS

	January 1985	December 1984	January 1984
Average prime rate (%)	10.61	11.06	11.00
Retail sales ($ billions)	110.686	109.872	106.602
Unemployment rate (%)	7.3	7.1	7.9

Unfavorable price developments in the U.S. electronics industry nudged the *ElectronicsWeek* Index down half a point in the latest week. The glut in semiconductors caused component prices in general to fall 0.6%. Because of oversupply and the strong dollar, prices will probably not firm in the near future.

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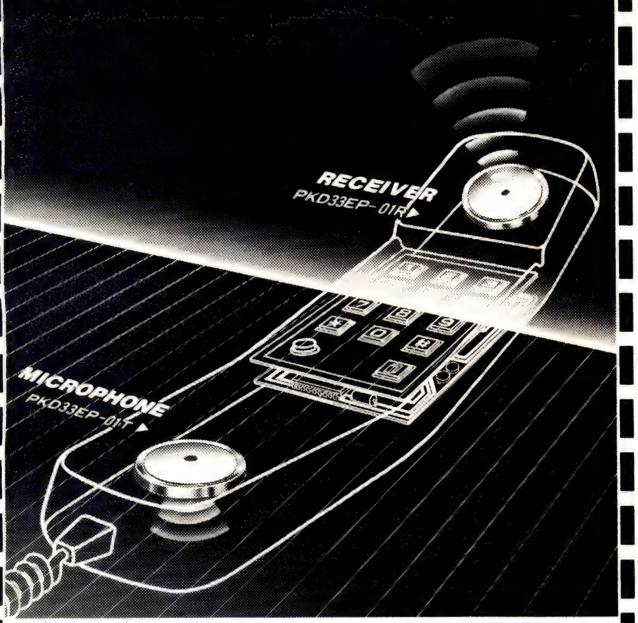

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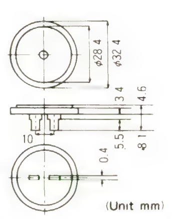
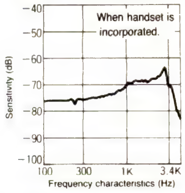


● Sensitivity & Freq. characteristics (Microphone)



‹Specifications›

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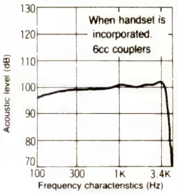
● Frequency range: 0.3~3.4KHz

● Acoustic level & Freq. characteristics (Receiver)



● Acoustic level: 105dB (1Vrms 1KHz 6cc coupler)
● Capacitance: 55nF (at 120Hz)
● Frequency range: 0.3~3.4KHz
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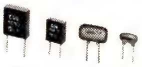
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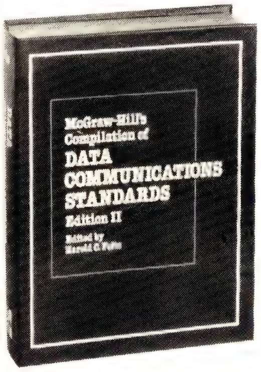
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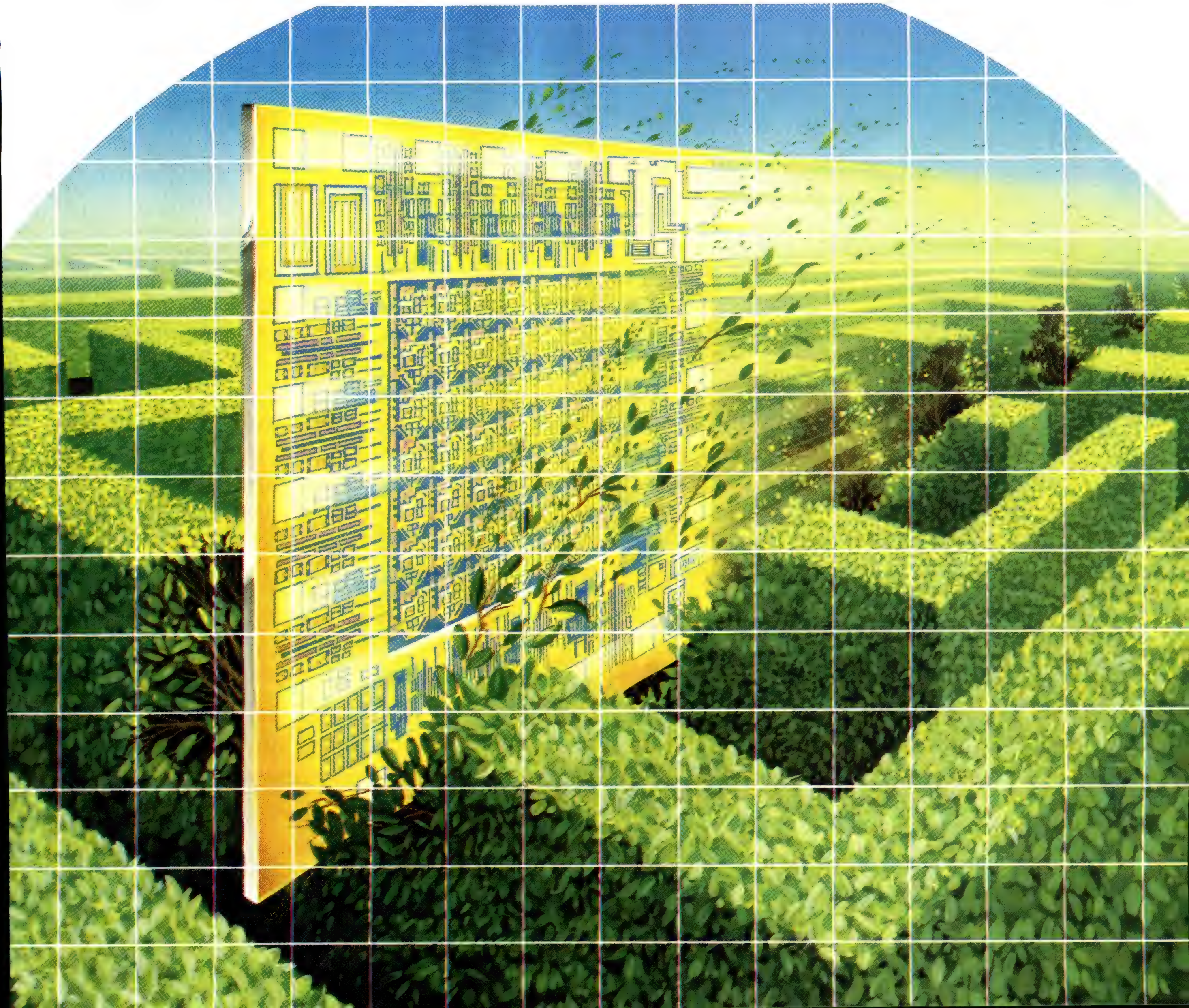
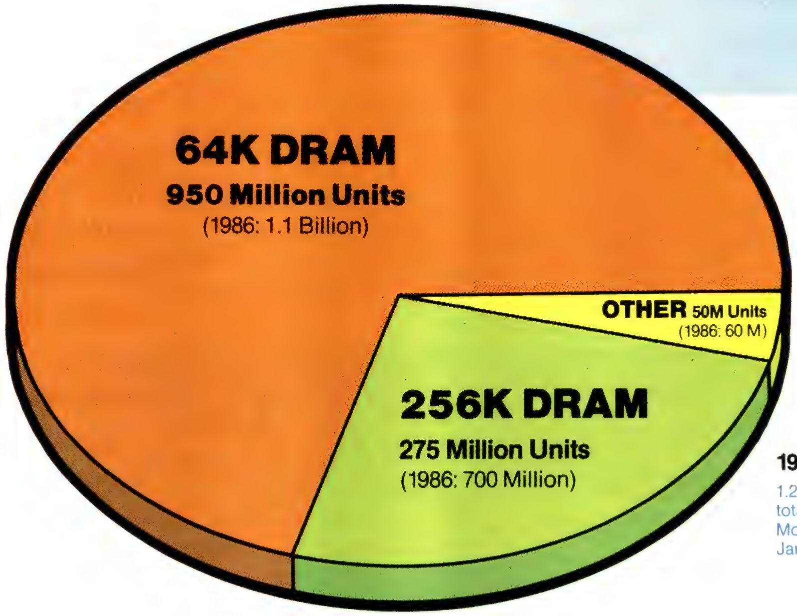


OKI shapes up today's DRAM markets...



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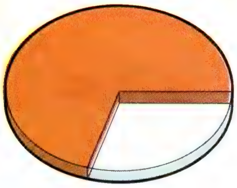

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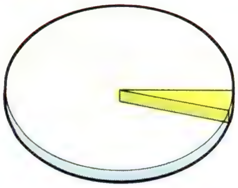

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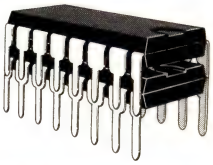

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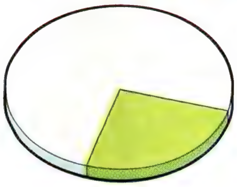

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SHAKEOUT DUE IN MACHINE VISION, SAYS MVA PRESIDENT WEST

Visionary advice. James K. West, first president of SME's Machine Vision Association, advises new machine-vision firms to focus on a market niche rather than build general-purpose systems.

Farmington Hills, Mich.

In 1981, there were five or six companies in the machine vision business, and today there are well over 100. I believe that the shakeout has got to start in 1985." Startup firms in the emerging machine-vision industry will find little solace in these words from James K. West, vice president and cofounder of Perceptron Inc., a maker of machine-vision equipment here.

West, named last month to be the first president of the seven-month-old Machine Vision Association of the Society of Manufacturing Engineers, claims that the way to certain death for a machine-vision manufacturer is to build general-purpose systems.

Find a niche. "We see so many machine-vision companies squander their resources by trying to do everything for everybody. [They] end up doing very little for anybody," he says. The 32-year-old West, who holds a BSEE from General Motors Institute and an MSEE from the University of Illinois, advises entrepreneurs to pick a market niche and focus on it.

"Because the U.S. manufacturing sector is in such dire need of this technology, there are literally hundreds—if not thousands—of potential application areas, many of which bear no continuity from one area to another." The key to this strategy, he says, is to choose a segment large enough to warrant an investment, yet small enough to handle.

As MVA president, West will help others in the machine-vision industry find attractive markets on which to focus. The association sponsors conferences, seminars, workshops, and publications for its more than 3,000 individual members.

For an industry populated with so many companies and individuals new to machine-vision technology, West is a relative veteran. He started working in the field in 1973 at the General Motors Technical Center, where he pioneered the software writing for specialized vision systems used internally at GM. One system was used to locate and sort castings on a moving conveyor belt; another verified the presence of keeper keys (devices that keep valve units properly oriented) in automobile engines.

West left GM to help found Perceptron in late 1981. "But at Perceptron, we've applied none of the technologies we developed at GM because the market is not attractive enough," he points out. Instead, Perceptron has chosen to focus on systems employed in durable-goods assembly, a class that, though relatively well defined, is broad enough to provide multiple applications.

The firm now sells a system that provides dimensional control in automotive sheet-metal assembly. A second product to be introduced soon can determine the orientation of automobile bodies moving down a conveyor line. **–Wesley R. Iversen**

MEGA'S FRIEDRICH AIMS TO CUT ASIAN LEAD IN MEMORIES

Munich

Given his 16-year background in research at Siemens AG in this city, Hans Friedrich admits that the corporate decision to pick him for a primarily administrative job is a bit unusual. Yet at his microelectronics research post, Friedrich "looked over the fence to our Components Division to get some insight into commercial aspects of the field." Indeed, company insiders testify to his excellent knowledge of the business side of microelectronics.

That knowledge, combined with his organizational talents, will surely come in handy now that senior director Friedrich heads the company's Mega project. In cooperation with N.V. Philips of the Netherlands, Mega aims at the volume production of 1-Mb dynamic random-access memories by 1987 and of 4-Mb DRAMs by 1989 [*ElectronicsWeek*, Oct. 29, 1984, p. 28].

Presiding over the birth of such advanced memories in Germany, Friedrich oversees an effort for which Siemens *alone* will put up more than $800 million during the next five years. That makes the Mega effort one of the largest single projects that Siemens, West Germany's No. 1 electronics producer, has ever undertaken.

Jogging and memories. Friedrich holds a PhD in physics from the University of Munich. Affable but energetic (the 45-year-old executive jogs for half an hour every morning), he notes that "being in rhythm with nature, many problems in professional life are seen in different terms and appear solvable through fresh ideas."

Friedrich offers several ideas on the reasons for the Mega project. Siemens, with sales of $15 billion, one of the world's heavyweights in the electrical and electronics business, considers it essential to play a leading role in microelectronics. "We simply cannot be second class," Friedrich declares. Memories not only enjoy exceptionally high growth rates in sales, he points out. They are also a technology engine in that they spur the development of other microelectronic parts.

But although Siemens is on Europe's leading edge in having started production of 256-K memories, the company remains an also-ran by Japanese standards. With each memory generation—a new one comes along every three years—Siemens has lagged behind the Far Eastern competition by about a year and a half. Friedrich says, "By the time we get into full production, prices start to decline."

Siemens hopes Mega will help it catch the Japanese memory producers—if not with its 1-Mb parts in 1987, then surely with its 4-Mb chips in 1989. The German company has the money to see Mega through. In addition, it has demonstrated that it can produce high-quality memory products—with IBM Corp. a customer for 64-K chips—and has acquired a high level of sophistication in production techniques.

Mega also benefits from Siemens's cooperation with Philips, Europe's largest electronics firm. The companies can pursue certain developments in parallel fashion or seek alternative solutions to different problems. Friedrich says, "This way, the risks can be held to a minimum."–**John Gosch**

Mega man. Hans Friedrich oversees the Mega project, Siemens's five-year, $800 million investment in memory technology.

AS HEAD OF STARTUP ELXSI, VIGIL TAKES ON A COMPUTER GOLIATH

Palo Alto

In August 1983, Jacob F. Vigil left the security of Burroughs Corp. to take on the challenge of being president and chief operating officer of computer startup Elxsi (pronounced El-ek-see). To do that, Vigil, 48, had to draw on his 24 years' experience, most recently as vice president and general manager of the systems group charged with developing Burroughs' computer systems.

Hitting the DEC. Now at the front lines of the industry battlefield, he will direct Elxsi's marketing effort against a formidable opponent: Digital Equipment Corp. Vigil must help organize and focus the marketing campaign he hopes will entrench Elxsi's superminicomputer, the System 6400, in head-to-head competition with Digital's newly announced VAX 8600 machine.

"It's very difficult to compete with Digital," says Vigil. "They have some 40,000 systems installed today, and there's a book two inches thick of applications programs for the VAX. But if Digital had our machine, it couldn't build enough to satisfy the marketplace."

Vigil claims the 6400's capabilities have delighted the computer-aided-design market. The 6400 can configure and reconfigure the scalar processor for anywhere from 1 to 10 central processing units, resulting in a processing capability of up to 40 million instructions/s. It has 192 megabytes of main memory. In its smallest configuration, using one CPU, the 6400 can run 4 mips—using either Elxsi's proprietary operating system, its version of Unix System V (called Enix), or both.

Vigil believes a lack of applications software is preventing Elxsi from getting a solid grip on the CAD market. But as Elxsi's software bank grows, so will its user base. "In May of 1984, we had no accounts in the CAD arena," Vigil says. "In June, just a month later, we came out with three significant applications programs for CAD and immediately installed six systems for that purpose."

Vigil wants to sell more 6400s to semiconductor companies. "We already have a very large base of designers of integrated circuits—companies such as Kodak, GTC, Sierra, AMCC, Brooktree, and VTI [VLSI Technology Inc.'s new initials]. VTI, in fact, just bought its second system to set up in its Boston design center." In addition, Vigil says Elxsi plans to sign with a well-known, as yet unnamed, IC house very soon.

The company expects revenues for 1985 to be about $50 million—which is more than double 1984's figure. And Vigil says that a $5 million agreement with Japanese distributor Nissho Iwai will help Elxsi reach that goal. –**Denise Caruso**

Giant killer? As president of startup Elxsi, Jacob F. Vigil will pit his company's 6400 computer against Digital's VAX 8600.

ZYCAD FLIES HIGH IN UNCHALLENGED POSITION

Arden Hills, Minn.

In the electronics industry, a so-called technology breakthrough can quickly create a high-flying business for its developer. Zycad Corp. is one of the latest flashy examples.

For the moment, at least, the 3½-year-old company founded by former Control Data Corp. engineers has grabbed an unchallenged position at the high end of what industry watchers are calling a new segment for hardware accelerators within the $800 million computer-aided design and engineering market.

Significant gain. What Zycad has done is to use supercomputer design techniques, which were refined at Control Data, to build a special-purpose hardware simulator that will run the socks off conventional software-simulation packages used on general-purpose computers. The company's first product hit the market 2½ years ago [*Electronics,* July 28, 1982, p. 125]. Known as the Logic Evaluator, it performs complex digital logic-simulation tasks some 100 to 1,000 times faster than equivalent software simulators.

This month, Zycad is shipping its first major enhancement of the system to beta sites at Data General Corp. and Digital Equipment Corp. Known as the Fault Evaluator, it will be offered at $150,000 to $215,000 at mid-year as a modular field upgrade that will significantly increase the fault-simulation capabilities of the system.

Though the Logic Evaluator can do fault simulation serially in addition to its mainline logic-simulation task, the Fault Evaluator will employ parallel processing and a pipeline architecture. The result is fault simulation about 100 times faster than the original model, Zycad says.

In one benchmark run involving about 3,000 gates and 3,100 faults, the Fault Evaluator performed a fault simulation in 31 s, versus 19 min on the Logic Evaluator and about 10 hours on a DEC VAX-11/780 running a software-simulation package, says Howard Krohn, Zycad's chief scientist.

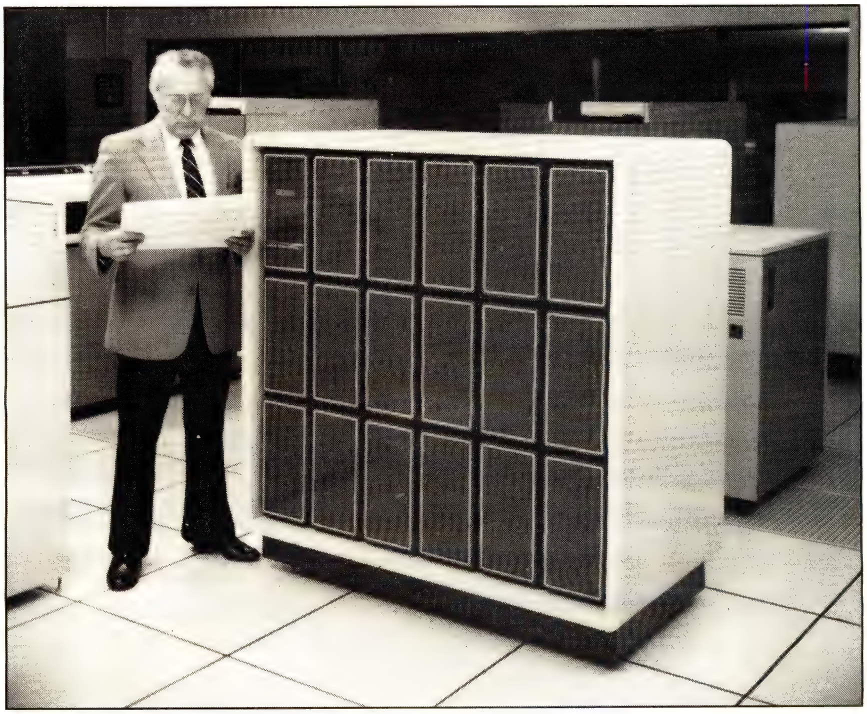
Depending on the model, the Logic Evaluator sells for between $300,000 and $2 million and provides its greatest value to sophisticated users with very large simulation requirements. The system is offered as a peripheral that can be tied to existing CAD/CAE installations for offloading computation-intensive simulation tasks.

Compared to available software logic simulators, which typically process between 2,000 and 4,000 events per second, the single module LE-1001 can process 500,000 events/s. Better yet, the high-end 18-module LE-1032 pushes the rate to a blazing 16 million events/s.

Though it expects competitors eventually, Zycad is currently the only game in town when it comes to hardware accelerators that attack bottlenecks in high-end CAD simulation systems. As a result, the firm has been able to turn in an impressive financial performance.

Zycad has already shipped more than 60 Logic Evaluators to 48 different customers and is running about a year ahead of its original business plan, says president Richard Offerdahl. Its list of customers includes big industry names such as Data General, DEC, Fairchild Camera & Instrument, Mitsubishi, and Texas Instruments.

High profitability. When final results are in, Zycad's 1984 sales are expected to total about $20 million, up from $4.1 million in 1983. What's more, because of its unchallenged market position, Zycad has been able to maintain gross profit margins in the range of 75% to 80%, which led to about $5 million in after-tax profits last year.



At the top. Though it expects competitors, Zycad is currently the only game in town when it comes to hardware accelerators that attack high-end CAD-simulation bottlenecks. As a result, the firm, with its Logic Evaluator, has been able to turn in an impressive financial performance.

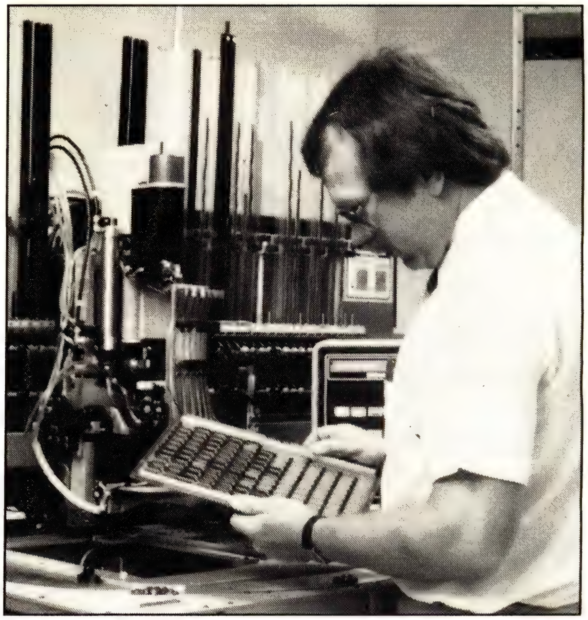
Industry analysts predict Zycad's sales will grow another 50% to 75% this year. And some, including Michael J. Dunn, vice president of Rothschild Securities Corp., believe a lack of competition may even allow Zycad to maintain similar high margins for the foreseeable future.

Given Zycad's financial track record, however, most think that competition will sooner or later be attracted to the market. Zycad raised some $28 million in its first public offering last summer. "And as soon as you put out a prospectus with those kinds of numbers, you're guaranteed that there are groups of engineers sitting around at 10 or 12 companies that they [Zycad] are selling to that are starting to doodle around with plans to start a business," observers Gary Smaby, senior vice president and technology analyst at Piper, Jaffray & Hopwood Inc., one of three firms to underwrite the Zycad stock offering.

Possible danger. The entry of other suppliers, of course, could seriously affect Zycad's future sales and margins. Indeed, for such high-flying startups as Zycad, history has proven that the fall from the top can often be as steep—and as fast—as the climb up, when larger or more technologically advanced competitors jump into a market.

Timely introduction of new products and enhancements will also be important. Zycad was late during last year's third quarter in shipping several Logic Evaluator systems incorporating some customized enhancements. This caused the firm's stock to plummet—to around $8 a share, down from its original $14 issue price. As of mid-February, however, Zycad shares had climbed back to the $14 range.

In fact, other special-purpose hardware packages aimed at CAD applications are already beginning to appear, though they are not in the same performance league as the Zycad system. Engineering work-station vendors Daisy Systems, Valid Logic Systems, and Mentor Graphics have all either introduced or announced plans for low-end hardware accelerators to be used with their work stations. Other competitors, including Accelerated Solutions, Silicon Solutions, and Star Technologies are also believed to be working on systems.



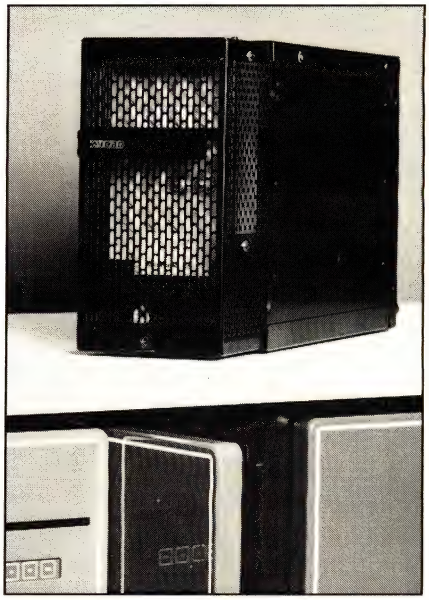
Looking ahead. Zycad has invested heavily in R&D for future upgrades and new products. Such attention to detail is necessary in order to maintain the company's market lead.

IBM Corp. has developed a hardware simulator for its internal use that is said to have faster performance than the Zycad product. But Zycad officials believe the potential market for high-end CAD hardware simulators is too small to attract IBM or other heavyweights.

"Large companies want significant market size before they're willing to fund and go after a market," maintains John A. Fahlberg, Zycad treasurer and vice president of finance. "We believe competition will come over the years, but we tend to think it will come from the startup-type companies."

Not attractive. Despite lofty near-term predictions for future Zycad performance, the question of market size for the firm's high-end-oriented products is one that has some in the industry wondering. "A lot of companies are looking at the high-end market as limited," says Smaby of Piper, Jaffray. And although they use a strategy similar to Zycad's, these firms don't plan to go head to head with the Minnesota firm, he figures. Instead, they will likely introduce hardware engines with performance levels aimed somewhere between low-end work station accelerators and the high-perfomance systems supplied by Zycad.

For his firm's part, Offerdahl says Zycad has identified about 25 giant electronics companies with large simulation needs that could use multiple Logic or Fault Evaluator products—perhaps as many as 50 or more. A second tier is made up of about 200 companies that have smaller CAD-simulation requirements, but which might need one to five Logic Evaluator-type products each, he says. Depending on which figures are used, that translates to a potential for some $500 million to $725 million in sales over the next several years.



Pluggable. Zycad's Logic Evaluator features a design that allows from 1 to 18 modules to be plugged into the system.

Zycad budgeted $3.2 million for research and development last year, and it plans to maintain heavy R&D spending for future Logic Evaluator upgrades and additional new products aimed at maintaining the company's market lead, Offerdahl says. One development project currently in the works involves a hardware accelerator to attack circuit-simulation problems currently handled by software programs such as Spice, first developed by the University of California at Berkeley. The circuit-simulation engine is planned for product availability some time in 1986, officials say. **–Wesley R. Iversen**

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SPECIAL REPORTS

SMDs TAX BOARD TESTERS

A variety of board-testing systems are being brought to market to cope with the SMD and VLSI challenge ☐ *by Howard Bierman*

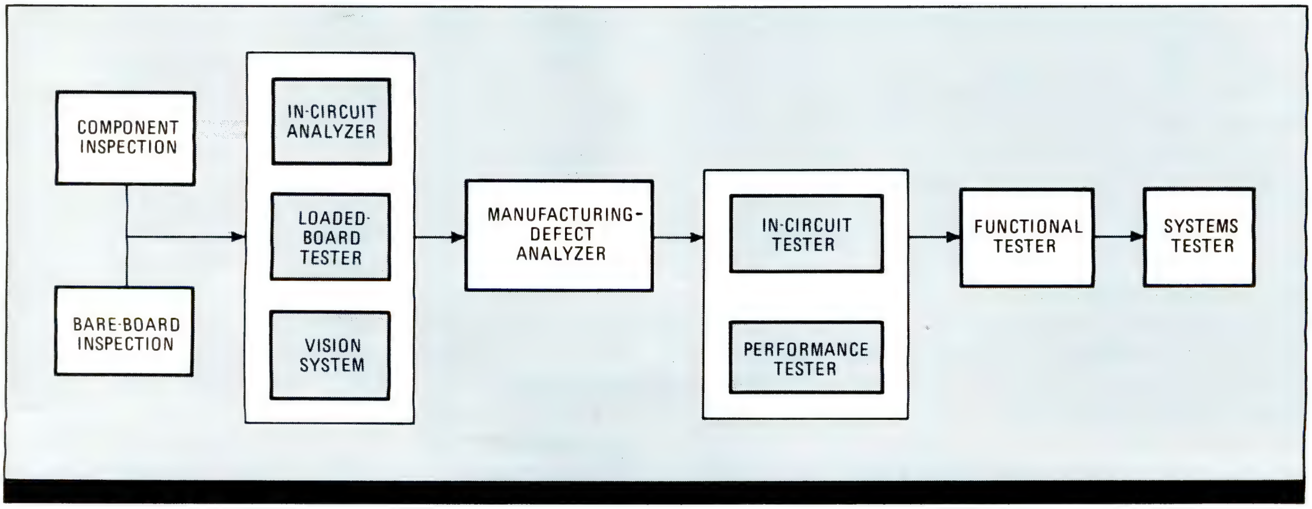
Today's industry needs pc-board testing more than ever. The increasing density of printed-circuit boards full of complex very large-scale integrated circuits along with surface-mounted devices with few or no probing areas greatly increase the chances of board failure, according to two recent studies.

In one study, Testerion Inc., a supplier of bare-board testers, revealed that failure rates for today's typical double-sided and multilayer bare (unloaded) boards exceed 18%. Double-sided boards show a 14% average failure rate and multilayer boards a rate higher than 21%. The majority of failures result from shorts caused by etching, solder coating, and misregistration. Fortunately, most pc-board failures can be repaired.

Another study, conducted by Logical Solutions Inc., vividly demonstrates the economics of detecting board faults at the earliest possible test stage. According to the company, it costs 50¢ to find a defect at the bare-board level, $5 a fault at the loaded-board level, $50 a fault at the final-assembly level, and $500 a fault once the product has been shipped into the field. The study further shows that, depending on board complexity, failure rates for loaded boards can reach 50%, with many repairs at this level difficult or even impossible to make because of the dense environment.

Manufacturers can choose from among various board-test strategies, with equipment prices that range from $10,000 to more than $1 million (Fig. 1) and continue to soar. At the low end, loaded- and bare-board testers screen out multiple shorts in a single pass. In-circuit analyzers rapidly pinpoint board shorts and defective components such as resistors, capacitors, and semiconductors. Bare-board testers make contact with as many as 10,000 test nodes on the underside of the board by means of closely spaced probes in a bed-of-nails fixture—a series of spring-loaded probes designed to be forced against the board's solder side at specified test nodes.

The majority of today's complex boards, however, need more thorough testing. Manufacturing-defect analyzers and in-circuit testers identify such board problems as opens, shorts, and missing, incorrectly inserted, or defective components. At the high end, functional testers put the board through its intended application by applying required stimuli through edge connectors. The choice



1. Testers abounding. Manufacturers seeking adequately tested boards rely on bare- and loaded-board testers, vision systems, manufacturing-defect analyzers, and in-circuit testers feeding functional and final-system test setups.

2. Powerful in-circuit tester. Factron/Schlumberger's System 770 in-circuit tester features an advanced analog architecture to handle as many as 3,072 hybrid pins. The tester can address time-related specifications for digital fault coverage.

of testers depends on board complexity, the volume of boards to be tested, the throughput desired, and cost. Test setups usually combine several schemes, because each offers different advantages and suffers from different drawbacks.

In-circuit testing is based on the belief that if individual connection points on a board have been checked and cleared for opens and shorts and if components have been tested for correct value and placement, the board will perform properly. In short, good parts make a good board. By contrast, a functional tester exercises the board to see if it performs its intended function. Individual elements on the board are not examined separately.

In-circuit testers

In-circuit testers measure shorts, opens, and the performance of individual components by electrically isolating, or guarding, each element from the rest of the board. First, the tester checks passive devices (resistors, coils, transformers, and capacitors) with the board unpowered. Next, it applies power to check active devices (transistors, diodes, and so forth). In-circuit testers, because of their ability to check and isolate individual parts, are powerful tools for locating and diagnosing board faults. Although their test times cannot beat the rapid go/no-go speeds of functional testers, they can identify multiple faults on a board in one pass, and functional testers cannot. Costs for in-circuit testers range from several hundred thousand dollars upward, including automatic software for generating test programs. Depending on the board's complexity, test-program generation and debugging may take a few weeks or a few months.

Communication between an in-circuit tester and the board to be tested takes place through a bed-of-nails fixture. As boards become more crowded with complex multipin VLSI chips, the cost of bed-of-nails fixtures rises sharply as does the time needed to design the fixture. Some firms that have invested in in-circuit testers are finding fixture costs soaring from $3,000 to triple that sum for the more elaborate, closer-tolerance designs needed to test today's boards.

Perhaps the greatest challenge to users of in-circuit testers is the proliferation of surface-mounted parts on boards. The inability to position a probe physically at key points—along with the fear of damaging delicate components if a probe nicks an SMD—gives fixture designers a headache.

Functional testers

Functional testers put the assembled board through its paces by simulating the various stimuli dictated for board performance and measuring the responses. They can detect all board problems but are aimed at flagging dynamic faults such as timing or racing problems. At first, functional testing became popular by handling logic boards. Analog testing was considered the realm of in-circuit testers because testing analog performance through edge connectors was complicated. Mixed boards until recently were relatively unusual, although that is hardly true today.

During the past few years, functional testers have lost ground as the tester of choice because their in-circuit counterparts were cheaper, required less time to program, and offered more responsive diagnostics. But as boards now include high-density digital and analog VLSI chips, the price and turnaround-time differential between the two approaches has eroded. In addition, in-circuit fixture for SMDs has blurred the distinction even further.

Functional testers offer users an extremely fast go/no-go test rate but one hampered by a very slow diagnostic time. Functional testers can locate only one fault on a board per pass while in-circuit testers can find multiple faults per pass. However, they can uncover dynamic performance flaws—such as timing or racing discrepancies—that in-circuit testers cannot handle. Fault diagnosis with functional testers involve interactive steps using guided probes. The test operator is informed on the testers' display screen where to place the probe and of readings to be measured. A typical functional tester that deals with analog-digital boards costs from $300,000 to well above $1 million.

The in-circuit testers that were unveiled at conferences this past year reflect the trend to mixed analog-digital boards. The 2276 board-test work station from GenRad Inc. provides 1,152 fully hybrid pins that can drive and sense at 5 MHz, with each pin backed by 8-K-by-4-bit memory. Besides the test pins, there are 16 high-speed clock pins, 8 synchronization pins, and 28 event-trigger pins. In a single test burst, the unit can test dynamic random-access memories of up to 1 Mb and static RAMs of up to 64-K by n. The ability to check cyclical redundancy exists at every test pin to check programmable read-only memories, ROMs, and programmable logic arrays. Priced in the $200,000 range, the 2276 tester includes fully integrated analog functional testing, with such options as a function generator, an ac voltmeter, and a timer counter. Eight channels route signals from the analog functional tester to the unit under test.

Zehntel Inc. recently unveiled its model 860, priced at $300,000, which handles as many as 2,480 hybrid pins. The tester takes care of routine digital and analog measurements, and a family of analog test modules can perform precision analog tests.

Factron/Schlumberger offers its System 770 in-circuit tester (Fig. 2), which sells for $185,000 and up and handles up to 3,072 hybrid pins. Based on a unique flexpin architecture that eliminates guard-pin contention and a dedicated 68000 microprocessor for control and test data analysis, the tester can rapidly check boards, including hybrid devices such as digital-to-analog and analog-to-digital converters, and filters. With timing resolution down to 10 ns, dynamic real-time vector control, and pin-formatting capabilities, the System 770 can detect device-timing faults and apply test data up to 10 MHz. When required, the system can be synchronized to an on-board oscillator running at speeds of up to 50 MHz. The flexpin architecture, which backs unused pins with static drivers, giving the automatic program generator and the programmer responsible for debugging flexibility in assigning guard pins—reduces board programming time.

Section-by-section testing

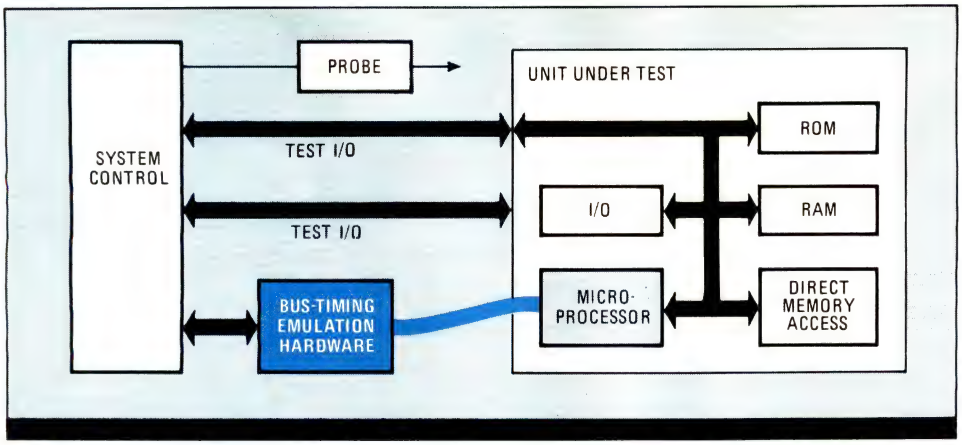
Functional testers with in-circuit capabilities are available from firms such as Teradyne, Everett-Charles, and Dialog Systems. At the high end of the line is the L200 from Teradyne Inc., priced from $700,000 and up depending on options and power needs. The board to be tested is separated into small sections, and the various VLSI chips are checked using test patterns supplied by the semiconductor manufacturers or truth tables generated by the device's data sheets. After the chips in each small section have been tested, the section itself is checked. Finally, all the small sections are tested together as an entity. The L200 board test system can be configured with as many as 3,034 10-MHz test pins and uses a PDP-11/44 host computer with 2 megabytes of memory, expandable to 4 megabytes. A twin-cartridge disk system stores system software, and a 456-megabyte Winchester disk handles on-line storage.

Computer Automation Inc. has been supplying its Marathon 8200 functional test station to manufacturers of digital, analog, and hybrid boards. With 20-MHz clock rates and test-cycle rates of 5 MHz, the tester can locate timing-related faults on boards housing state-of-the-art VLSI chips. Hoping for business from small-volume board manufacturers, Computer Automation last month unveiled its $110,000 Compact functional tester (Fig. 3). To keep the price within reach of low-budget manufacturers, the tester, which occupies 6.6 ft^2 of floor space, has a modest 352 pins, 4-MHz real-time pin modules, a 32-megabyte Winchester disk drive, and a 10-megabyte streaming tape drive. The system's cost is low because the company designed it in a standardized configuration rather than in modular form for later add-ons.

Manufacturing-defect analyzers

Cheaper than in-circuit testers, manufacturing-defect analyzers, such as the 3200B from John Fluke Manufacturing Co., are designed to test boards for shorts and opens as well as for missing, wrong-value, or improperly placed parts. These testers, priced at $60,000—approximately one third less than the cost of in-circuit testers—are marketed on the premise that component vendors have considerably improved the quality of their products and have thus lessened the need to check components inserted on the board. This notion has found support in Japan, where some consumer-product firms assert that building products properly in the first place enormously reduces the need to test. (In fact, on some Japanese

3. Low-cost functional tester. Computer Automation Inc.'s compact tester, priced from $110,000, is designed to meet the needs of price-sensitive factories with small production runs. The 352-pin tester requires only 6.6 ft^2 of space on the floor.



4. Bus-timing emulation. In this performance-tester scheme, the tester tristates the board's controller and then emulates the input/output structure to exercise the board's logic functions. The emulation hardware generally consists of fast random logic.

production lines, without test steps, more than 98% of the products leaving final assembly perform perfectly.)

Although in-circuit testers require special isolation or guarding techniques that are expensive to implement and program, manufacturing-defect analyzers do not use guarding and claim high-speed measurements capable of spotting 80% of board faults. An additional 10% of board failures can be caught if the analyzer is followed by an in-circuit tester, with the remaining burden of weeding out defects assigned to a functional tester fed from the in-circuit test system. Companies selling this gear claim that if large-volume board manufacturers use the analyzers as a prescreening step, they can improve the economy of their test operations by reducing the load on their in-circuit testers.

Performance testers

To reduce the mounting cost of testing bus-structured boards, firms are providing performance-test systems to exercise boards at their full design speeds. While functional testers have input stimuli and output responses routed to and from a board through edge connectors, performance testers gain entry to the board through its microprocessor or memory.

The performance-test approach offers manufacturers of large-volume boards densely packed with high-speed VLSI parts a universal programmable test system that can detect and diagnose dynamic interactive defects not caught by earlier in-circuit or bare-board testers. The three approaches that follow all involve emulation techniques. The Columbia C2000 system from Zehntel Performance Systems uses bus timing. The arrangement offered by Fluke uses the in-circuit approach. The 2720 tester from GenRad uses the memory approach, as does the series 3065 from Hewlett-Packard Co.'s Manufacturing Test Division.

In the bus-timing emulation technique (Fig. 4), the tester tristates the controller (that is, puts it into a high-impedance mode) on the unit under test, taking over and then controlling and communicating with all on-board components by emulating the input/output structure of its controller. The tester behaves as though it were the microprocessor on the board under test. Other components on the board are not aware that the unit is controlled by an outside source.

Fast random-logic hardware synchronizes the clock of the unit under test and creates address, data, and control signals identical to those of the unit's controller, but managed by the test program. High-level dynamic instructions that allow short program statements to apply long test sequences with high speed and accuracy simplify programming. Using the tester in an interactive mode, a test engineer can prepare programs quickly, without the need to understand the machine language of each microprocessor on the market.

Six classes of processor cycles—read, write, input, output, op-code fetch, and interrupt acknowledge—permit the microprocessor to control and communicate with other devices on a bus-controlled board. A tester that can emulate and exercise these cycles can send and receive signals on specific lines at times defined relative to the microprocessor clock. Thus, it can check the conformity of the microprocessor's timing sequences.

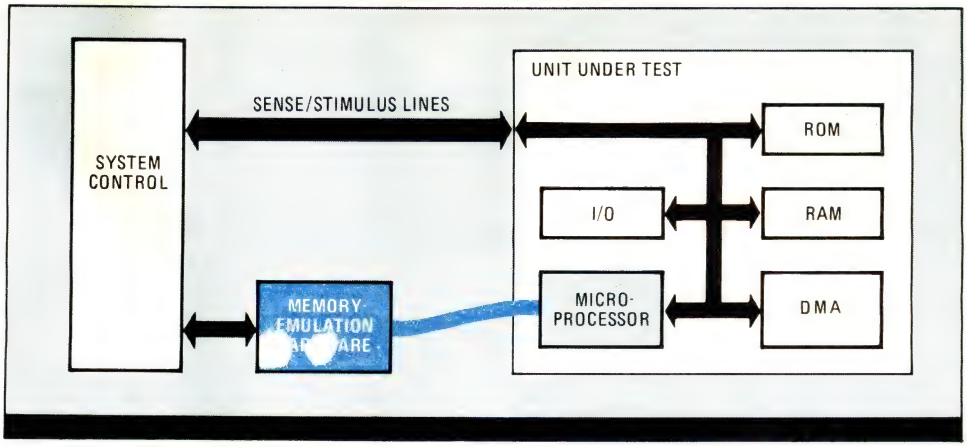
In-circuit performance

The in-circuit performance approach (Fig. 5), originally used with benchtop testers and microprocessor development systems, is intended to check microprocessor-based boards. To conduct the test, the board's unit under test is removed and replaced by the tester's emulation probe, housing the same kind of microprocessor that was taken away. A test program stored in the performance tester's memory and fed to the board through the emulator probe checks the board's operation.

Fluke's 9000 series Microsystem Troubleshooters apply the in-circuit performance scheme through an interface pod. To diagnose the cause of a defect, the 9010 Troubleshooter includes a probe that, in the stimulus mode, applies a pulse from the interface pod to synchronize such microprocessor events as address or data periods. In the response mode, the probe takes signatures, counts events, and indicates high/low logic states. Lengthy manual diagnostics take less time because the performance tester can undertake simple read/write data operations or more complex operations, such as automatic generation of walking ones/zeros patterns and digital-incrementing ramps that can be repeated, looped, and start/stopped at the test operator's command. The tester supports a full range of 8-, 16- and 32-bit processors, including the Z80, 6080, 8080, 8088, and 68000. Fluke's 9010A language compiler lets a test engineer develop troubleshooting programs off-line using a personal computer.

With memory emulation (Fig. 6), the microprocessor of the board under test is assigned the task of exercising the digital functions with a program stored in the tester's memory. A technique called capturing selectively overdrives the microprocessor control lines, forcing the board's microprocessor to execute the code contained in the tester's memory. The microprocessor then proceeds to exercise the various devices on the board to provide performance status and necessary service diagnostics at key locations.

GenRad's 2720 performance-test system, intended for boards housing 8086 or 68000 microprocessors, includes 1,024 high-speed sensors to collect data at speeds of up to 32 MHz for reference against a data base known to be good. Included in the stand-alone test system are a 68000-based host computer with a 1.5-megabyte memory, memory-emulation interface modules, on-line assemblers and disassemblers for interactive debugging, and a logic waveform display.



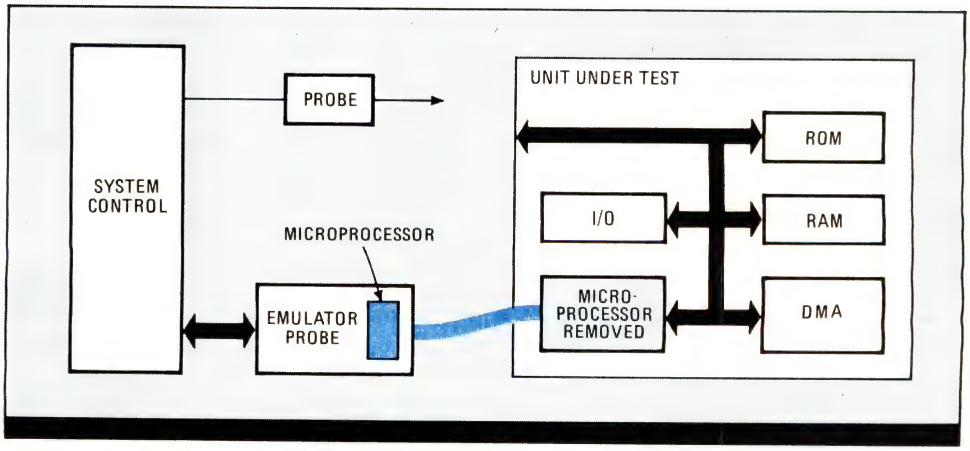
5. In-circuit emulation. The microprocessor on the board under test is removed, and the tester's emulator probe is plugged into the integrated-circuit socket. Then the probe's microprocessor executes the test program that is stored in the tester.

The impact of surface mounting

Although SMDs have been designed into military equipment for more than a decade, they were first used in consumer and industrial products in Japan about six years ago. To keep pace in the unending struggle to compete with smaller, lower-cost, higher-quality assemblies, U.S. manufacturers are racing to apply SMDs in their product designs.

The most popular package size for SMDs today uses 50-mil-center spacing, with 25- and even 10-mil packages on the horizon. Marketers who believe that smaller sells better are pressing design engineers to beat the competition with tinier, pocket-sized TVs, telephones, stereos, and other entertainment products. Seasoned industry observers, however, think the rush to SMDs will come to an abrupt halt unless clever, innovative test approaches appear. Companies in the early stages of SMD assembly have experienced frustrating production delays and wasted expenses caused by the lack of package standardization, inexperience with SMD soldering procedures and board assembly, and inadequate SMD IC-handling equipment. They also realize that cooling fins or some other kind of heat sinking must be used to dissipate the heat generated in boards that are tightly packed with SMDs.

SMDs are available either with very short leads or no leads external to the body of the components. Leaded devices are attached to the pc board by direct application of solder to the component leads so that only a small contact area lies next to the device under test (Fig. 7). SMDs with no leads have contact pads beneath the component body, attached directly to the board with no visible contact area for testing. Conventional pc boards using conventional through-hole-mounted components let a conventional bed-of-nails fixture touch test points on the solder side of the board. SMD assemblies, however, offer target areas of less than 0.05 in. and sometimes no access at all.

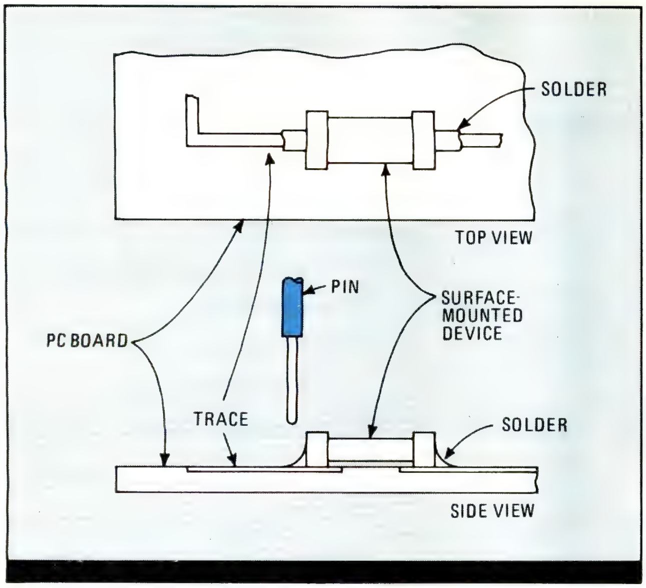


6. Memory emulation. Using a technique called capturing, the tester selectively overdrives the microprocessor control lines, thus forcing the microprocessor to execute the code stored in the tester's memory. Synchronous sensors supply diagnostic information.

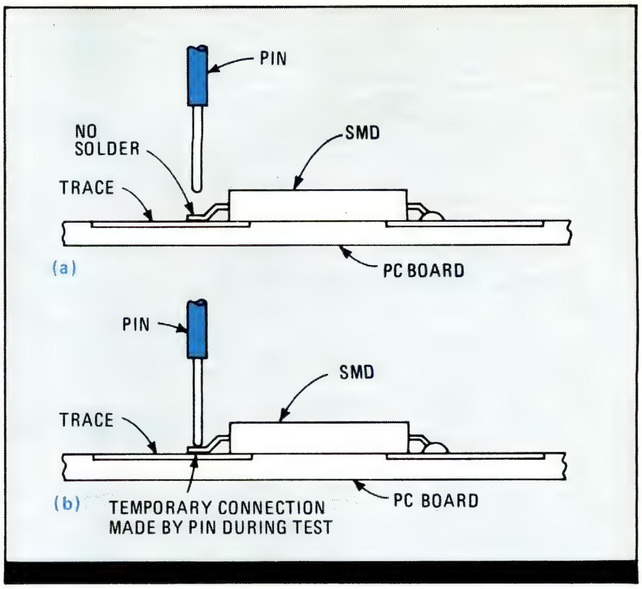
Double-sided trouble

When SMDs are mounted on only one side of a board, it is possible, but difficult, to use narrow probe pins to make contact with the top side of the SMD lead. Even this technique involves serious test problems, because the test probe's spring pressure may force a poor solder joint to make temporary contact with the board trace but fly open after the test passes inspection and pressure is removed (Fig. 8). The recent trend to increase board density by using SMDs on both sides of pc boards has further aggravated a serious test problem. Moreover, double-sided fixtures boost fixture expense and design time significantly and generally call for air-cooling schemes.

To provide the accessibility that in-circuit testing of SMD-loaded boards requires, designers should follow several key recommendations. First, they should provide test pads with 0.032-in. diameters for single-sided fixtures and 0.034-in. diameters for double-sided fixtures using



7. Space squeeze. Surface-mounted devices make little or no area available for test probes. Test engineers must resort to tiny, fragile, accurately located probes with 50-mil centers to avoid damage to the probe or to delicate SMD components.



8. Wrong reading. One problem with surface-mounted devices is the possibility that defective or open solder joints may pass test when the probe pin presses the SMD lead to the board trace. After the probe is removed, the circuit will fly open again.

100-mil-center probes. For 0.050-mil-center probes, the test-pad diameter for a single-sided fixture should be 0.040 in.—and 0.043 in. for a double-sided fixture. Despite claims by suppliers of 50-mil-center probes, users insist that they encounter problems with the fragile construction and recommend conventional 100-mil probes if at all feasible.

Companies forced by tight space restrictions to use 50-mil probes should permit enough probe travel to prevent damage to the probe or to SMD components: if probe contact occurs too close to the chip component, the probe may strike the part, damaging the probe or the component, or resulting in an incorrect reading. Users should avoid probing the solder pads that attach the SMD to the board and should design test pads along the trace pad at a distance from the solder pad. Finally, to save time and money, designers should avoid double-sided fixtures.

Fixture wiring

As digital speeds increase, aided by the use of short lead lengths on SMD-populated boards, the wiring inside the bed of nails becomes a significant factor. With sharp 10-MHz-frequency (and higher) pulses routed from board to tester, the fixture wiring exhibits such disturbing effects as crosstalk, capacitive loading, ringing, and slow backdriving. These effects occur because the connections to the fixture behave as poorly terminated transmission lines do. The solution to crosstalk is to use twisted pairs or coaxial cable.

When a digital IC output is backdriven, its impedance drops to several ohms, and the mismatch with the fixture wiring can generate transients that upset the test measurement. One solution is to add a gate to the test board to disconnect the intractable circuit; another is to keep the connections short.

Ringing can produce double clocking on high-speed circuits, destroying test results. In this case, a matched terminating resistor is shunted across the fixture nail to ground. Capacitive loading will make the output of an MOS circuit on a test board appear to change states slowly. To reduce ringing, a matching terminating resistor is placed in series with the fixture nail. The general recommendations for fixture wiring are to keep wires as short as possible, to use twisted pairs to reduce coupling, and to use terminations to reduce reflections.

Future trends

The growing belief is that the test function should help eliminate faults in the production process and not just identify them. Indeed the ultimate goal of production setups, oddly enough, is to eliminate the test function entirely by concentrating totally on manufacturing. Production without testing is a long way off, however.

Clearly manufacturers are now improving production-process steps to upgrade product quality, reduce costs, and speed product throughput. To help them accomplish these goals, test firms are creating and improving management information report systems, failure trend analysis schemes, and sophisticated factory-distributed data bases. These techniques let managers pinpoint in real time the causes of faults quickly enough to apply corrective steps. Vendors are offering local-area networks to convey the large amounts of data collected from test stations, but additional effort is required to link the wide variety of automatic test equipment with different interfaces.

Analysts who cover the ATE market see the combined in-circuit and functional-board-test market growing from 1984's $650 million to $750 million in 1985 and topping $1.5 billion by 1988. Although in-circuit sales accounted for $400 million in 1984, with $250 million spent on functional testers, industry observers believe that board complexity and SMDs will increase functional-tester sales to $900 million in 1988, with sales of in-circuit testers increasing to $600 million. ☐

DOD SPENDING SPURS MARKET

Defense gear relies increasingly on electronics components, with new and mature technologies to benefit ☐ *by Mark T. Spence*

A broad look at trends in component markets in the U.S. indicates robust growth for active components and a mixed bag for passives. A major reason is defense: real growth for the defense industry is slowing but remains high by past standards. Department of Defense outlays grew 6% in 1984 in real dollars but will decelerate to 5% per year through 1988. Over the last 30 years, real growth has averaged under 2% per year.

A healthy sign for component manufacturers is that DOD priorities are moving from research and development programs to procurement; as more programs come on line, the demand for subassemblies and components will increase. And even more important for the electronics industry, defense equipment is relying increasingly on electronics components. Hence the demand for military-grade parts—particularly semiconductors—is outpacing the growth for the defense industry at large.

Production of defense electronics equipment was expected to advance 14.5% in 1984 and 13.0% this year. By contrast, in 1981 the value of defense electronics equipment production jumped a full 23.2%. The demand for military-grade semiconductors will advance 22.9% in 1984 and 20.1% this year.

In 1988, the rate of growth will still exceed 20%, after two years in the 17% range, primarily because more defense programs will reach peak production levels. Microprocessors and state-of-the-art memory chips, *such* as those based on CMOS technology, will grow at least 30% annually.

Consumption of passive components is paralleling the demand for defense electronics equipment. The growth rate will drop from last year's 15.7% to 14.4% this year. In general, the value of passive components relative to a complete piece of equipment is slowly decreasing over time, largely because the functions performed by discrete passive components are now being embedded in solid-state semiconductors.

The U.S. economy experienced a better-than-anticipated surge in activity in 1984, expanding a full 11.3% over the last year to $3.68 trillion. Indicators of the state of the U.S. economy include:

- Capital spending increased a full 21% in 1984, not

TABLE 1: U.S. PRODUCTION OF ELECTRONIC EQUIPMENT
(Billions of dollars)

Category	1984	1985	1986
TOTAL	184.0 Value ($)	207.0	234.0
	16.7 Growth (%)	12.2	13.1
Business and retail	9.1	9.6	10.5
	7.5	5.1	10.0
Communications	29.8	34.1	38.3
	13.6	14.3	12.4
Consumer	13.8	14.6	15.7
	17.1	5.6	7.2
Computer	62.2	71.2	82.4
	20.0	14.6	15.7
Government and military	37.9	42.9	48.1
	14.5	13.0	12.3
Industrial	15.5	16.9	18.9
	18.1	9.1	11.9
Instruments	15.8	17.5	19.8
	22.5	10.4	13.5

including inflation, and this year's capital growth is projected to wind up somewhere in the 8% range.

- Real growth in the gross national product will drop below 2% this year, as rising interest rates curb consumer credit lines and decrease aggregate demand.
- Exports grew 6.3%, net of inflation, in 1984 with imports up 25%.

DOD outlays jumped 11.2% in 1984 to $223 billion. In 1985, DOD outlays will total approximately $246 billion, up 10.1%. Slightly over 6% of the U.S. economy is defense related, and this percentage will edge up as the growth of the U.S. economy slows and the growth of DOD outlays remains relatively stable. Likewise, government and military electronics equipment is outpacing the growth rate of DOD outlays. Hence expenditures on defense electronics equipment is becoming an ever-larger share of total DOD outlays.

The electronics industry is just over the crest of its strongest wave of growth in recent history. At the end of 1984, U.S. production of electronics equipment surged ahead 16.7% over 1983, measured in current dollars; it will increase 12.2% by the end of 1985 (Table 1). Particularly strong expansion in the communications- and computer-equipment markets will contribute to a nearly 35% growth rate (in current dollars) for semiconductors in 1984 and a more than 15% rate of increase in 1985. Growth for the passive-component industry reached 17.4% (in current dollars) in 1984 and will total 11.3% in 1985.

The U.S. business and retail market, which includes office equipment, copying machines, and coin-operated video games, grew 7.5% in 1984. High growth in the telecommunications market resulting from deregulation and new technology will push production in the communications market up more than 14% in 1985.

Slower growth

This year, however, will bring much slower growth for consumer electronics. After a burst of buying over the past several quarters, demand for TV sets will slacken, particularly as consumer finance rates edge up. Slower growth expected in the housing industry for 1985 will depress sales of home electronics, such as security and fire alarms. Production of auto electronics will moderate as higher interest rates dampen sales of new cars.

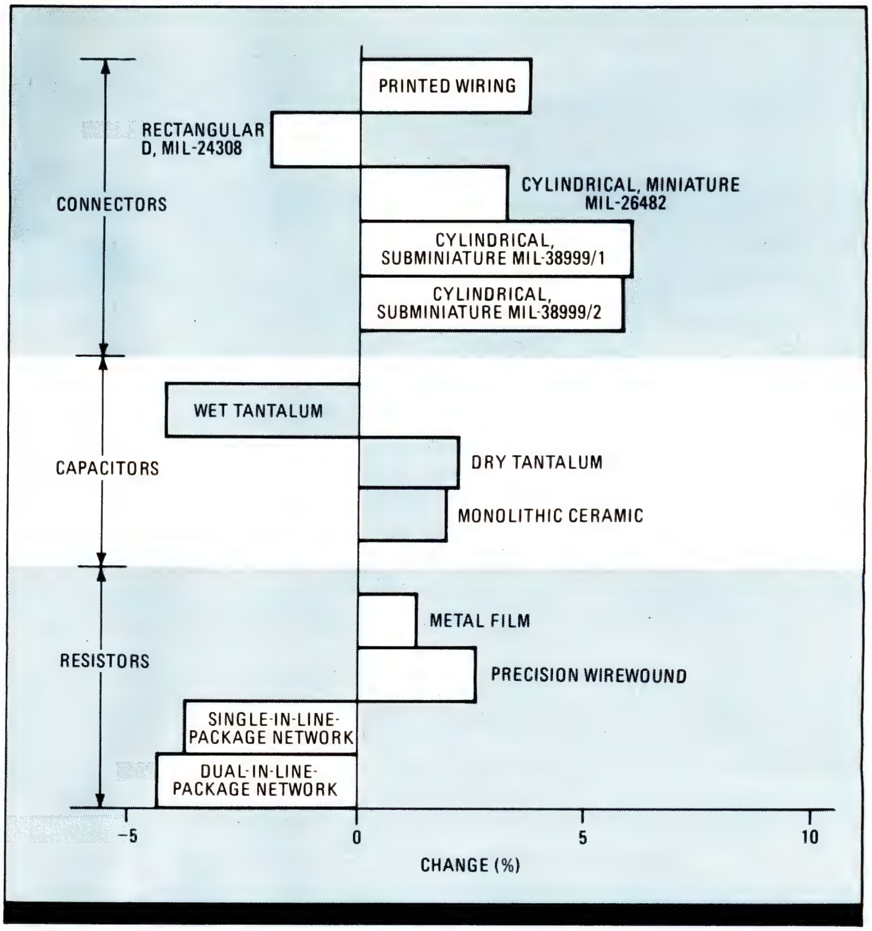
TABLE 2: U.S. COMPONENT PRODUCTION FOR DEFENSE ELECTRONICS EQUIPMENT
(Millions of dollars)

Category	1983	1984	1985	1988	Average annual growth (%) 1983–1988
TOTAL PASSIVE	1,933 Value ($)	2,237	2,560	3,636	13.5
	15.4 Growth (%)	15.7	14.4	13.7	13.5
Relays	90.21	98.86	102.0	123.5	6.5
	5.74	9.59	3.13	11.3	6.5
Switches	86.74	90.26	92.96	95.35	1.9
	5.53	4.06	2.99	2.89	1.9
Connectors	791.0	921.4	1,063	1,568	14.7
	17.2	16.5	15.4	15.3	14.7
Capacitors	291.5	315.5	345.3	398.8	6.5
	9.92	8.25	9.44	6.24	6.5
Resistors	150.3	166.8	183.8	216.6	7.6
	14.6	11.0	10.2	4.97	7.6
Printed circuits	523.5	643.9	772.3	1,234	18.7
	20.0	23.0	19.9	17.3	18.7
TOTAL ACTIVE	1,557	1,913	2,298	3,841	19.8
	20.1	22.9	20.1	21.7	19.8
Discretes	461.4	500.7	559.4	764.8	10.6
	8.6	8.52	11.7	10.1	10.6
Linear ICs	224.9	298.6	355.6	528.2	16.6
	20.4	22.0	19.2	18.2	16.6
Digital ICs	850.3	1,114	1,383	2,548	24.5
	27.3	31.0	24.2	26.4	24.5

With capital spending projected to grow at about a third of the 1984 rate, investment in computer equipment will grow 14.6% in 1985, down from 20.0% in 1984. The industrial and instrument markets are more sensitive to swings in the business cycle, and so growth there will slow more dramatically in 1985. The moderately slower growth for production of government and military equipment reflects the slower growth in military spending in the 1983 through 1985 federal budgets.

Production of military-grade electronics components was mixed; some categories grew over last year while others suffered. But in general rates were up.

For total passive-component production, the rate of growth increased from 15.4% in 1983 to 15.7% last year (see Table 2). Through 1988, the growth rate of passive-component production will average 13.5% per year. Similarly, total production of active components edged up nearly three percentage points, from 20.1% in 1983 to 22.9% last year. Through 1988, the rate of



1. Mixed bag. As manufacturers of connectors and capacitors continue to increase their production capacity, industry observers expect that heavy competition will keep price increases to a moderate level.

growth will average 19.8% annually. Growth rates will tend to slow in 1985-1986 before picking up again in 1987-1988, as more programs enter the production phase.

In 1984, the value of production of passive electronic components for the defense market was 17.3% of total passive-component production. The government's share of total semiconductor production was smaller, accounting for 14.1% of the total value of production. These percentages, particularly for active components, will decline as the commercial market continues to outpace the defense market.

Because of the relatively small size of the military end-market compared with the commercial sector, some original-equipment manufacturers have become concerned that component vendors are losing interest in the manufacturing of military-qualified parts. Fewer vendors would mean less competition, longer lead times, and higher prices [*Electronics-Week,* Feb. 4, 1985, p. 63].

The military market, however, is more stable than the commercial market. In fact, it tends to be countercyclical, expanding most rapidly when commercial demand is off. Because of this, chip manufacturers should maintain a client base of military contractors to offset some of the volatility evident in semiconductor manufacturing.

Thus it is unlikely that outright parts shortages will develop. Nonetheless, the subtle interplay between the commercial and military markets will continue to cause perturbations in lead times and price trends.

The demand for military-grade connectors increased 16% in 1984, which was quite high relative to other categories of passive components. Vendors have added sufficient capacity to keep up with the rising demand. Lead times therefore have held steady at 10 to 20 weeks. Prices for the popular MIL-C-38999 connectors have advanced moderately at a rate that is roughly equivalent to the general level of inflation. Connector manufacturing is inherently labor-intensive; therefore, barring any price wars, like the ones that occurred in 1982, prices will continue to advance, pushed by rising wage costs.

Component manufacturers overestimated the demand for wet-tantalum capacitors, causing oversupplies and prices that dropped 10% and more over the last year. The oversupply was a result of the ban on CLR-65 wet-tantalum capacitors in future military use and a miscalculation of the rapidity of the changeover to the CLR-79 wet-tantalum capacitor. Consumption of CLR-79s doubled over the last year and will likely double again in 1985. Prices for dry-tantalum capacitors held steady in 1984, and only moderate price advances are expected.

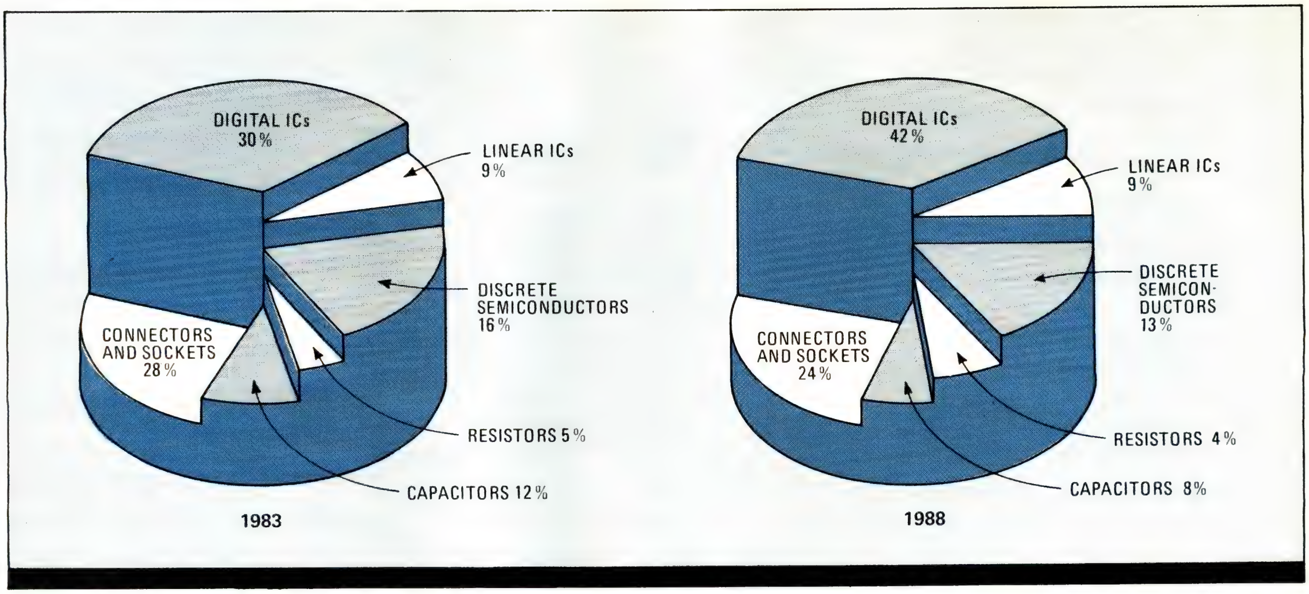
Despite the labor requirements involved in testing monolithic ceramic capacitors, prices have advanced less than the inflation rate and will continue to do so as production yields continue to increase (Fig. 1). Prices in 1984 advanced 3.5%; from 1985 to 1988, yearly price increases will not exceed 2%.

Active-component trends

Military integrated-circuit manufacturing promises to be a healthy market. A robust 18% annual growth can be expected for the more mature technologies. New technologies—for example, high-density CMOS memories—could increase at twice that rate.

Generally, prices will advance, although the rate of increase will vary widely depending on product type. The very mature standard and low-power Schottky TTLs will increase in price at a rate equal or exceeding the rate of inflation. No longer are there ways to significantly improve production yields. For LS, demand remains strong, with standard Schottkys being displaced by advanced Schottky parts. Because of the expected rapid expansion of advanced Schottky sales and increased competition among vendors, prices for these parts are expected to fall after 1985.

Emitter-coupled-logic continues to be the fastest logic device available, operating at speeds under 5 ns. The technology, however, is mature. Some vendors are unwilling to expand their capacity to keep up with the



2. Component consumption. Consumption of digital integrated circuits will swell to 42% of the government's component consumption in 1988—a 12% increase over 1983 levels. Meanwhile, passive and discrete ICs are predicted to drop by 8%.

demand because they prefer to pursue newer technologies instead. Thus prices are being bid up: this year's average selling prices will increase 9.1%, and lead times may stretch as long as one year.

The market for dynamic random-access memories in military applications is anything but pessimistic, with the value of production increasing at least 25% annually. Though n-MOS is the prevalent technology, by 1988 over half the military demand will be satisfied by CMOS parts, which consume less power and therefore generate less heat. The workhorse for the next few years will be 64-K DRAMs, with prices edging up 4.6%. Some of that increase comes from implementation of the more stringent MIL-STD-883C specifications. Declining prices are projected after 1985.

Prices for static RAMs, however, will advance 4.7%, pushed up by two factors. First, the 16-K SRAM field is dominated by one manufacturer. Furthermore, SRAMs are inherently difficult to manufacture, which is why SRAM densities are a full generation behind DRAMs. Nonetheless, competition is mounting, and modest price declines are projected for 1986 through 1988. Orders are being taken for 64-K SRAMs, although only limited quantities are available. Joint-Army-Navy-qualified 16-K SRAMs sell for approximately twice as much as MIL-STD-883C parts.

Defense equipment is becoming increasingly dependent on microprocessors; hence phenomenal growth rates for both 8- and 16-bit versions are expected. The value of production will increase just under 30% per year for 8-bit microprocessors through 1988, and over 100% per year for 16-bit chips. Of course, 16-bit microprocessors are starting at a relatively low-quantity base, being outsold by 8-bit microprocessors 55 to 1 in 1984. By 1988, the quantity ratio (8-bit unit sales over 16-bit unit sales) will drop to the range of 8 to 1.

Profit potential is creating heated competition, particularly for 16-bit microprocessors. As a result, prices are projected to decline for these components through 1987 for all Joint-Army-Navy-qualified parts. Average selling prices for 8-bit microprocessors will be virtually unchanged for the next three years, at which time modest price increases will become the norm.

After much deliberation, Congress authorized $297 billion for defense expenditures for fiscal year 1985. The authorization level is the maximum amount, beyond which the DOD cannot spend. However, there is still much controversy over how much of the authorized funds will be appropriated in fiscal 1985. It is likely, after concessions have been made, that the appropriation bill will total $293 billion.

Paring the budget

If a $293 billion appropriation bill is passed, it would represent a 5% real increase in defense appropriations over fiscal 1984, less than half the real increase requested by the Reagan administration. Last February, the administration requested $314 billion for DOD expenditures. The primary reason for paring defense expenditures was to curb rising government deficits.

Appropriation dollars, however, are not all spent in the year authorized. Some of the $8.2 billion authorized for the production of 34 B-1B bombers, for example, will spent after 1988. Conversely, dollars appropriated in 1980 are being realized now. Actual DOD expenditures for the 1984 calendar year are projected to total $223 billion, with $38 billion spent on defense electronic hardware.

Approximately 17%—$2.1 billion—of total OEM consumption of electronic components in 1983 was accounted for by the military sector (Fig. 2) Of that amount, almost 30% was directed toward consumption of digital ICs, and another 28% was for consumption of connectors. By 1988, the total military consumption of passive and electromechanical components will reach $3.9 billion. Consumption of digital ICs will account for 24% of all military consumption by then. ☐

Mark T. Spence is a research project manager at Gnostic Concepts Inc., San Mateo, Calif.

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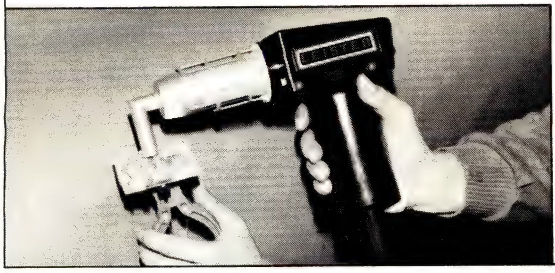

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BUS BAR POWERS SMDs

A bus bar carrying the power and ground traces that usually sit on pc boards cuts costs and increases component packing density ☐ *by Steve Zollo*

When surface-mounting technology was introduced to the market, it was hailed for its economy—both in terms of cost and space. But demand for ever greater savings in board real estate has spurred a need for devices that can increase pc-board density as well.

One company's response is a busing concept that provides power and ground distribution on a two-layer pc board while taking up a minimal amount of space. With more room for components, density is boosted.

Surf/Bus, a laminar bus bar consisting of two parallel conductive layers separated by a thin dielectric material, is sealed mechanically and electrically on the outside by insulating material.

Although surface-mountable devices can be smaller than conventional ones, the space saved can easily be eaten up by power and ground traces if a two-layer board is used. Similarly, if multilayer boards are used to imbed the traces, the cost saving that surface mounting promises goes down the drain.

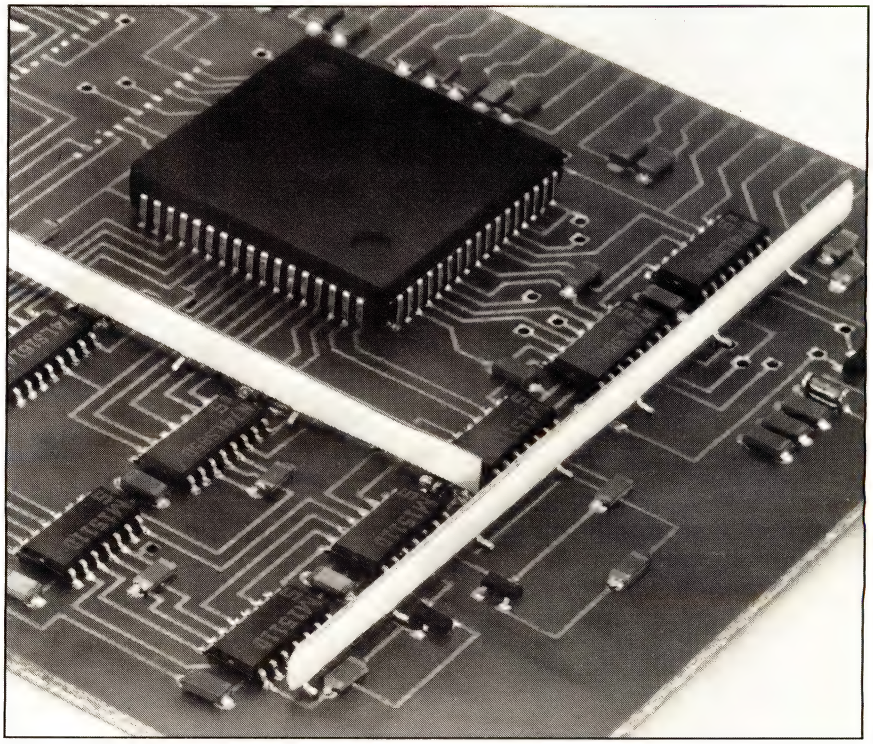
Mounting a bus on an outer layer and removing power and ground traces from the board allows for a more direct interconnection between devices, improves circuit performance, and eliminates the need for additional layers, says John Gardner, Rogers Corp. product specialist.

Most designs will involve the reduction of a four-layer board to a two-layer design. Because a typical multilayer board will cost about 30¢/in.^{2} and a two-layer board about 15¢/in.^{2}, a 6-by-8-in. two-layer board will be about $7.20 less expensive than a multilayer board.

Surf/Bus is mounted onto the board's solder pads by means of a set of very small feet (25 by 50 mil). This technique saves space by allowing signal traces to run under the bar. The feet, which are actually input/output tabs, can be located on 50-mil centers.

The bus bar performs as a low-inductance, low-impedance transmission line with significant reduction in needed decoupling capacitors, according to Gardner, thus saving additional space. Compared with a 4-in., 1-oz, 20-mil copper trace, Surf/Bus has higher capacitance (80 pF versus less than 1 pF), lower inductance (5 nH compared with 90 nH), and lower impedance (61 kΩ to 90 kΩ). The laminar bus can carry 2.5 A per conductor at 400 circular mils/A. Equivalent 1-oz copper traces carrying power and ground would require a combined trace width of 1.13 in. In addition, Surf/Bus bars can be used as a Faraday shield, either in a single-conductor construction or as both a power-distribution and a shielding element in a two-layer configuration.

In volume quantities, Surf/Bus ranges in price from



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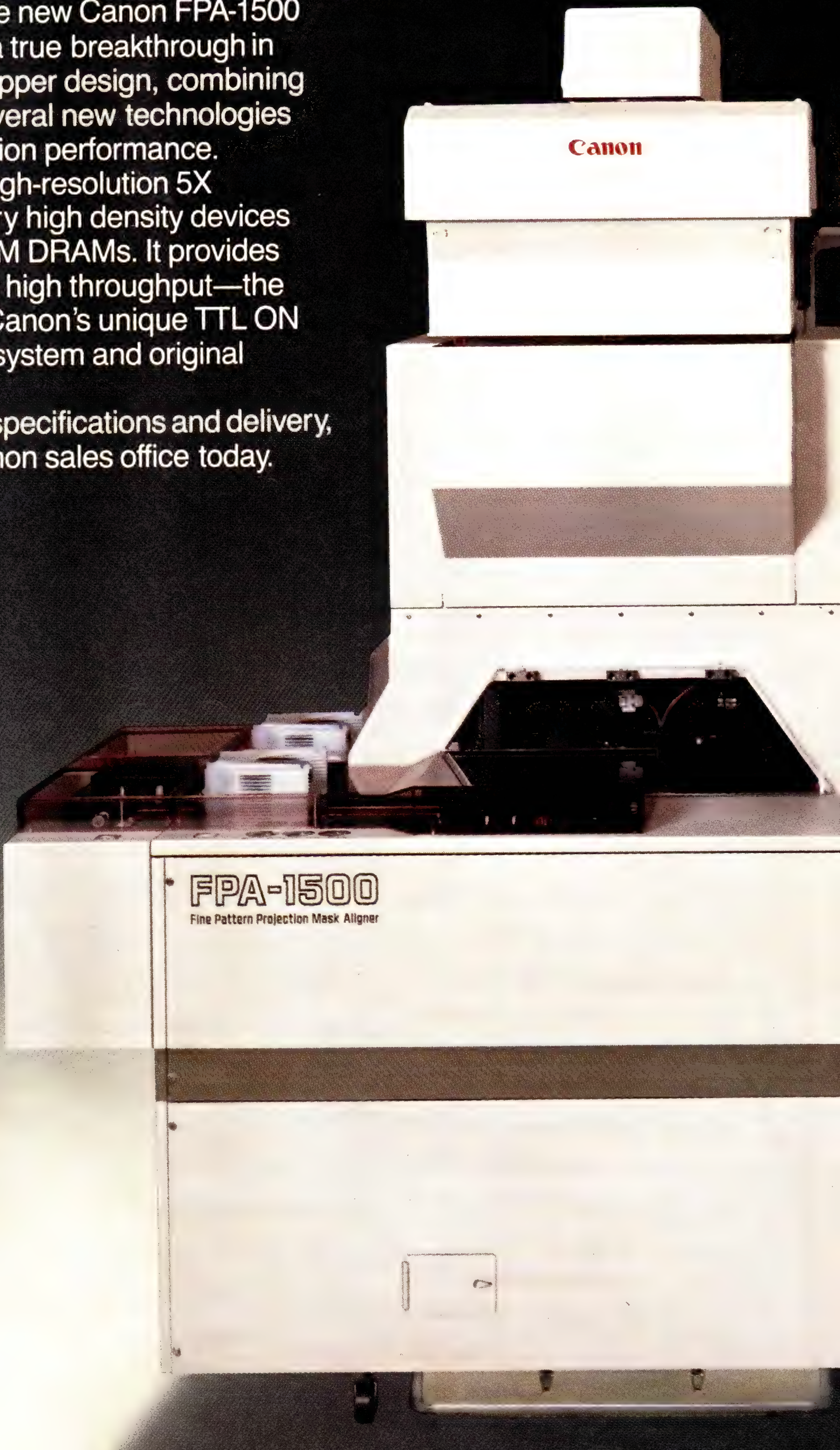
For information regarding specifications and delivery, please contact your nearest Canon sales office today.



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20¢ to $2.50, depending upon insulation and construction type and quantity. The Surf/Bus bars are currently available.

Rogers Corp., Bus Products Division, 5750 E. McKellips Rd., Mesa, Ariz. 85205.
Phone (602) 830-3370 [Circle reader service number 338]

Fast ECL RAMs have variable organizations

The high-speed MCM10422L10 ECL RAM features a typical address access time rated at just 7 ns—10 ns maximum. A reduced-speed version, the MCM10422L15, has a typical time of 15 ns.

The 1-K RAMs have 256-words-by-4-bit organizations and were designed for high-speed scratchpad, control-cache, and buffer-storage applications. Four independent 32-by-8-bit memory-cell arrays permit users to select 1-K-by-1-bit or 512-by-2-bit organizations as well as the 256-word-by-4-bit organization.

The two RAMs, fully compatible with Motorola's MECL 10K and 10KH logic lines, are in an industry-standard configuration and come in hermetically sealed ceramic 24-lead side-brazed packages.

Pricing, in 1,000-unit lots, is $25.20 for the L10 and $23.10 for the L15; in quantities of 2,500, prices fall to $10.90 and $8.10, respectively.

Motorola Semiconductor Products Inc., P.O. Box 20912, Phoenix, Ariz. 85036. Phone (602) 962-3151 [Circle 347]

DRAMs save space in high-density applications

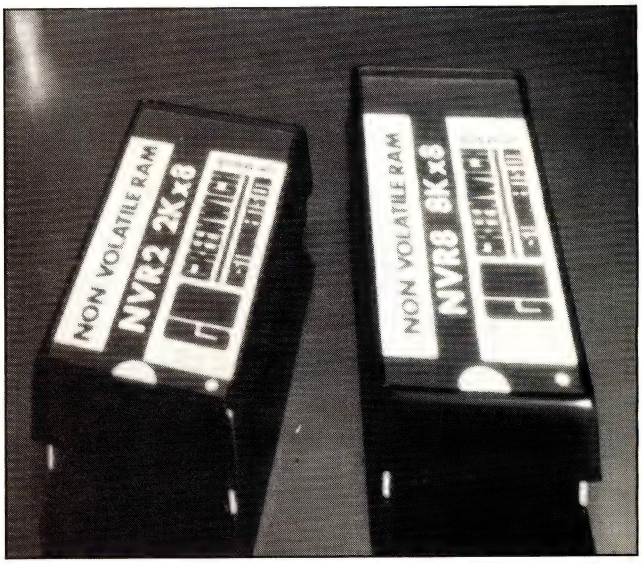
Two 256-K dynamic RAMs from Hitachi claim a 23% savings in board real estate over standard 18-pin dual in-line packages. The HM50256CP and HM50257CP come in surface-mountable packages to increase memory availability in limited-space applications.

Available with access times of 120 ns, 150 ns, and 200 ns, the DRAMs come in 18-pin plastic-leaded chip-carrier packages. The HM50256CP is suitable for page-mode applications, the HM50257CP for nibble-mode applications. Both are upwardly compatible with 64-K DRAMs.

In sample quantities of 100, the HM50256CP and HM50257CP DRAMs are priced at $20 each and are currently available.

Hitachi America Ltd., Semiconductor and IC Sales and Service Division, 2210 O'Toole Ave., San Jose, Calif. 95131.
Phone (408) 942-1500 [Circle 348]

RAMs carry lithium batteries to retain data for 10 years



Containing their own lithium power systems, the NVR2 2-K-by-8-bit and NVR8 8-K-by-8-bit RAMs require only 5 μA of standby current. The two nonvolatile RAMs, developed for extremely low-power applications, possess internal circuitry that can automatically retain data for 10 years or more upon power-down.

The power-down circuitry does not require any supply voltage slew from 4.75 to 0 V, thus eliminating the need for a large power supply. Available in industry-standard pinouts, the two RAMs can instantly convert a standard RAM card into a nonvolatile card of equal capacity, providing significant cost savings.

The RAMs, which include a write-inhibit bar to prevent unauthorized or accidental data changes, are available immediately. In lots of 1,000, the NVR2 sells for $22.10 each; the NVR8 for $55.25 each.

LMS Electronics, 3401 Monroe Rd., Charlotte, N.C. 28205.
Phone (704) 376-7805 [Circle 349]

Static-column DRAM features high bandwidth

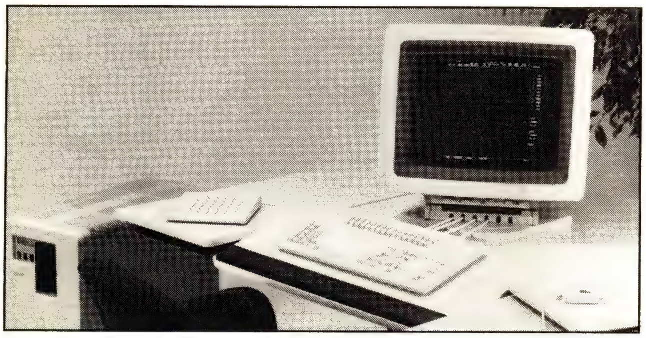
Available in two versions, Intel's high-speed CMOS static-column 64-K-by-4-bit dynamic RAM is expected to reduce the space required by small computer memories. Both versions have superior features over comparable CMOS and n-MOS designs, the company claims. The 51C259H takes particular advantage of the high-bandwidth benefits of CHMOS technology; the 51C259L emphasizes its low power requirements.

The L model, which is available now, has four times the memory capacity at less than half the cost per bit of most CMOS static RAMs on the market. The H model, which will be available in the fourth quarter of this year, will offer twice the bandwidth of conventional n-MOS processes for faster storage and retrieval. In lots of 1,000 or more, the DRAMs are priced from $28.75 to $48.65 each.

Intel Corp., Literature Department W-191, 3065 Bowers Ave., Santa Clara, Calif. 95051 [Circle 378]

Graphics work station uses VME-based graphics engine

Based on a proprietary graphics engine called Ocean, the Series 6000 high-performance raster graphics work station from Adage Inc. can be configured for applications ranging from monochrome drafting to full-color rendering of solid materials.



Each work station has its own dedicated controller and contains the Ocean graphics engine, a VME bus-based design that allows for flexibility and upgrading; a 32-bit processor; a bright, high-resolution raster display; and direct or remote connections to host computers.

The 6080 work station, the first in the series, boasts a 50-ns/pixel drawing speed and performs local pan, zoom, scroll, and highlighting. It offers a hardware cursor and user-selectable anti-aliasing capabilities, and can run a variety of software packages.

With 256-K bytes of system memory (expandable to 1.25 megabytes), the 6080 can simultaneously display up to 256 colors from a palette of 4,096. Options include IBM Corp. 3270 emulation, two- and three-dimensional transformations and clipping, and a range of communication options supported at speeds up to 3 Mb/s.

The work station comes with a 1,024-by-1,024-pixel, 60-Hz noninterlaced display that measures 19 in.; an antiglare screen for it is supplied. Also included are an alphanumeric keyboard, a data tablet with a stylus or four-button cursor, programmable function keys, and eight continuous turn-control dials.

Prices run from about $18,000 for a monochrome system to about $22,000 for a midrange 16-color configuration. The top-of-the-line 256-color model will sell for about $26,000. Shipments will begin in March.

Using the same engine, the company is offering the model 6080, a unit that is compatible with the IBM Corp. 5080 graphics system but is lower in price. Prices range from $18,000 to $22,000 for a typically configured system.

Adage Inc. One Fortune Dr., Billerica, Mass. 01821.
Phone (617) 667-7070 [Circle 350]

Protocol converter weds IBM mainframes to its PCs

A plug-in expansion board, the PC-80 from Innovative Electronics Inc. links IBM Corp.'s Personal Computers to its mainframe systems.

Using a standard Type-A coaxial connection, the PC-80 attaches an IBM PC or PC/XT to an IBM 3274/3276 cluster controller or to a 4331 Display/Printer Adapter. It suppports either the bisynchronous or Systems Network Architecture/Synchronous Data Link Control communications protocols.

The interface makes the IBM PC or PC/XT appear to the cluster controller as an IBM 3278 model 2, 3, or 4 monochrome display station. When outfitted with a color screen, the IBM PC/XT can appear as a 3279 model 2A, 2B, 31, or 3B.

Full 3278/3279 keyboard support is provided, including programmable function keys. Users can redefine or reassign any of the 3270's functions performed by the PC keyboard, providing near-total keyboard flexibility.

Additional features include dual-level password security. The expansion board can support concurrent PC-DOS and 3270 sessions and simplify operations through configurable help screens, as well as capture host screen data onto the IBM PC disk.

Optional IBM Host File Transfer Software can be used in conjunction with the PC-80 to provide menu-selectable file transfers between the attached Personal Computer and the host.

The price of the protocol converter, including the board and required software, is $895.

Innovative Electronics Inc., 4714 N.W. 165th St., Miami, Fla. 33014. Phone (800) 327-3955 [Circle 351]

Network interface cuts costs, connects eight devices

Cutting port-connection costs by as much as 27% while expanding the number of network management services available to users, the network interface unit NIU-180 from Ungerman-Bass can connect eight user devices to the company's Net/One local-area-network communications system.

The NIU-180, which uses the Intel Corp. 8018 16-bit microprocessor to execute network communication protocol, can transfer data rapidly under heavy traffic conditions. Thanks to an entry-point security feature, each of the network's eight ports can be configured for a separate password.

Other services available with the NIU-180 are idle circuit time-out, which automatically cuts a circuit if no data transfer occurs within a specified amount of time, and automatic baud-rate detection, which allows the

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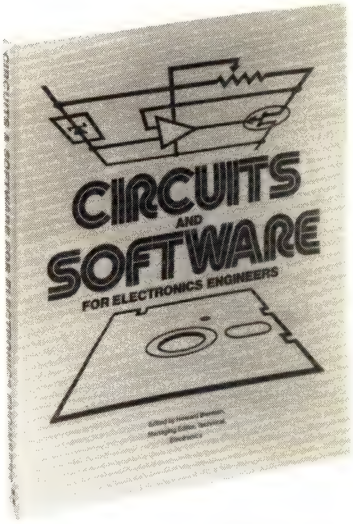

Edited by Howard Bierman, Managing Editor, Technical—*ELECTRONICS* Magazine

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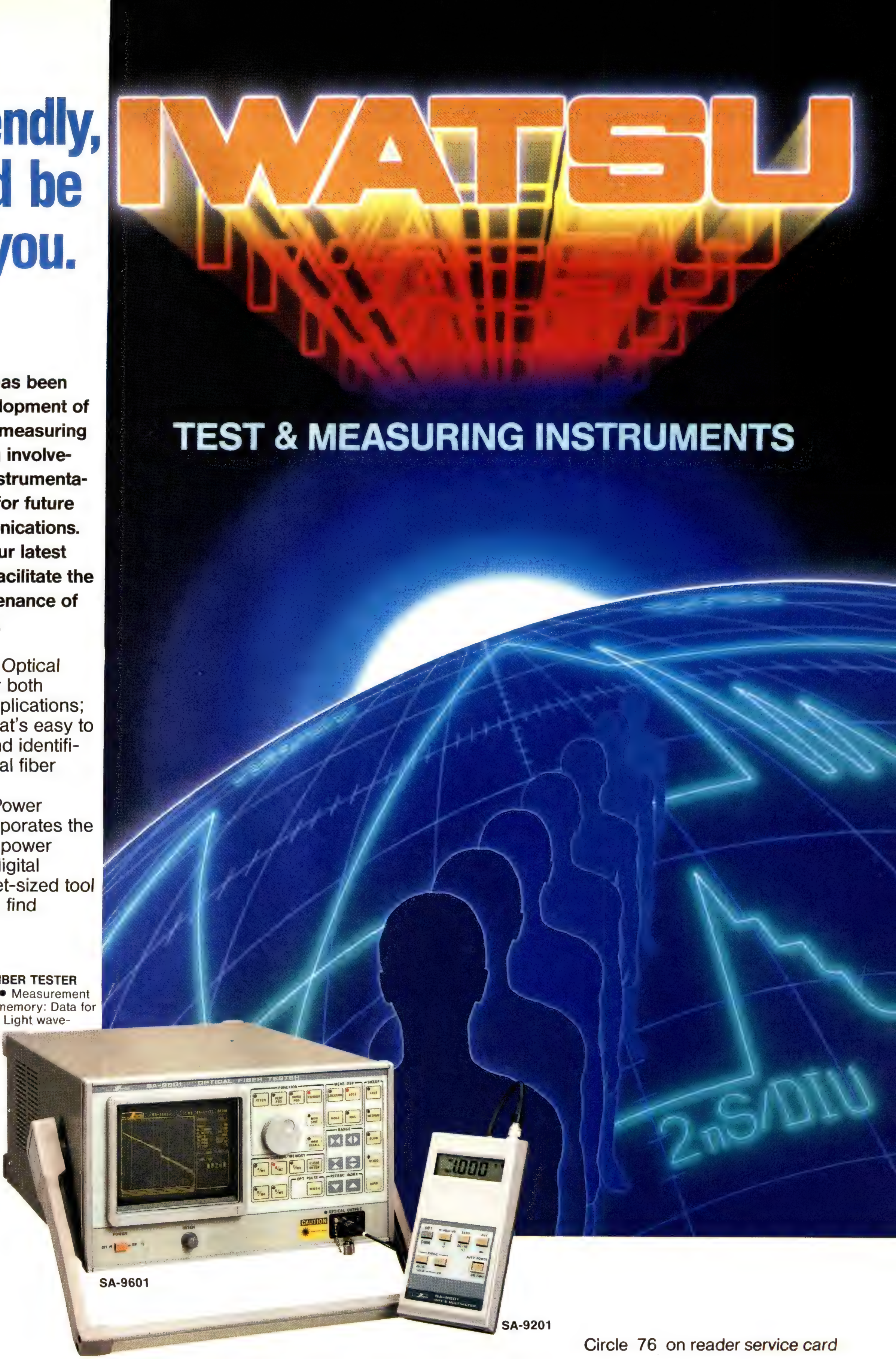

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network interface to detect the data rate of a variable-speed device and adjust for it.

The NIU-180 operates at 8 MHz and supports up to eight ports simultaneously running at 9,600 baud, with data rates up to 19,200 baud. It is compatible with all Net/One products and is supported on all four LAN media: broadband, baseband, optical fiber, and coaxial cable. The broadband model has an integral modem that transmits at 5 megabytes/s; the other models transmit at 10 megabytes/s.

Priced from $2,950, the unit is available 30 days from receipt of order. With eight devices, the cost per connection is about $370.

Ungermann-Bass Inc., 2560 Mission College Blvd., Santa Clara, Calif. 95050. Phone (408) 496-0111 [Circle 352]

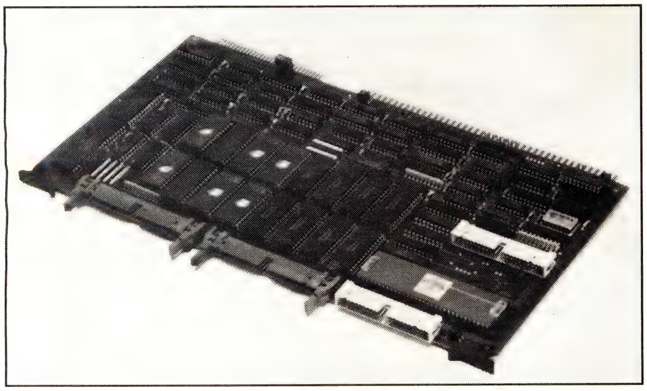
Interface boards link up minicomputers, work stations

Using its Netex software, Network Systems Inc. has built two interface boards for its high-speed communication networks. One board is for Multibus systems; the other is for Data General Corp. systems.

Called intelligent processor interface boards, they are designed for minicomputers and work stations. The boards act as coprocessors to perform various data-communications tasks when systems from one or several vendors are linked.

Netex software, the company says, is compatible with 18 different operating systems and facilitates file transfer, job transfer, and transaction processing at high speed on a real-time basis.

The boards are priced from $6,000 each, Netex included, and shipments are slated to begin in April.



Network Systems Corp., 7600 Boone Ave. N., Minneapolis, Minn. 55428. Phone (612) 425-2202 [Circle 353]

It's Monte Carlo night for design engineers

A circuit-analysis program, Acnap version 2, can perform Monte Carlo analysis, in which a number of circuits are "built" on the computer by randomly varying the component values within their specified tolerance range. Other analyses that Acnap performs include worst case, noise-equivalent bandwidth, and sensitivity.

Acnap version 2 analyzes circuits of up to 200 components and 30 nodes in a single pass. Then the program's circuit editor enables the designer to add, delete, or change components, tolerances, and node connections. The software, priced at $72.95, is available for computers operating under MS-DOS, CP/M-80, and PC-DOS.

BV Engineering, 2200 Business Way, Suite 207, Riverside, Calif. 92501. Phone (714) 781-0252 [Circle 357]

Translator converts Fortran into C language

Even as it translates Fortran into C, Fortrix-C+ retains all internal documentation, and input data files remain fully compatible with the new C program. Fortrix-C+ can handle common and equivalence statements as required by C. It also provides for character and direct input/output handling.

Fortrix-C+ runs in an AT&T Bell Laboratories' Unix environment. Its $4,200 price tag includes free maintenance and enhancement upgrades for one year. A non-Unix version, Fortrix-C', sells for $4,700. Fortrix-C/micro, for IBM Corp. Personal Computers and their compatibles, will be available in March, at a price to be announced. Upon request, the company will configure the Fortrix family of translators to work with any manufacturer's proprietary system.

Rapitech Systems Inc., 565 Fifth Ave., New York, N.Y. 10017. Phone (212) 687-6255 [Circle 358]

Intel's 80286 chip joins forces with Unix V

With Unix System V adapted for the 80286 microprocessor, that chip can now reach its full potential in multitasking and multiuser environments. The chip's features, which include memory management and protection, also eliminate reprogramming of the Unix kernel when Unix V is transported from one 80286-based computer system to another.

Called System V/286, the software is available now to Intel's customers. AT&T will market the source-code product to resellers and systems integrators who are building hardware and software products that use System V/286. Priced at $43,000 for the initial host 286 system and $16,000 for each additional host system, the software will be available in April of this year.

Microport Systems will market a binary-code version of System V/286 Release 2, Version 1 (a validated Unix System V port) for the Intel 286/310 system. This binary product includes the files needed by original-equipment manufacturers to reconfigure the product for 80286-based systems.

Intel Corp., Literature Dept. W-193, 3065 Bowers Ave., Santa Clara, Calif. 95051 [Circle 359]

Microport Systems, 60 Garden Court, Monterey, Calif. 93942 [Circle 379]

AT&T Co., Customer Information Center, P.O. Box 19901, Indianapolis, Ind. 46219 Circle 380]

Dc-to-dc inverter swaps roles, becomes converter

With the addition of two capacitors and a small signal diode, a dc-to-dc voltage inverter, model Si7660, becomes a supply-voltage converter. Thus modified, the Si7660 performs over an input range of +1.5 to +10.0 V, which results in a complementary output voltage of –1.5 to –10.0 V.

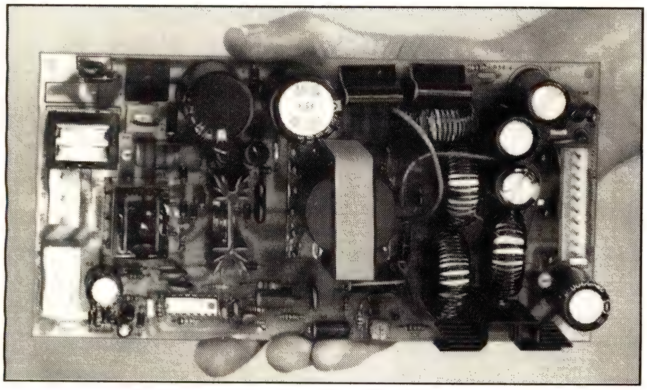
The CMOS monolithic Si7660 has a low output-source resistance that provides 99.7% efficiency with no load, or 95% conversion efficiency at 10 mA. Its single chip holds a voltage regulator, a resistor-capacitor oscillator, a voltage-level translator, four power MOS switches, and a logic network.

The Si7660 is available in either a TO-99 can or an 8-pin plastic DIP. In 100-piece quantities, the cost of the TO-99 package is $2.73 each and the plastic DIPs are $1.89 each.

Siliconix Inc., 2201 Laurelwood Rd., Santa Clara, Calif. 95054. Phone (408) 988-8000 [Circle 360]

Lightweight power supplies deliver isolated output

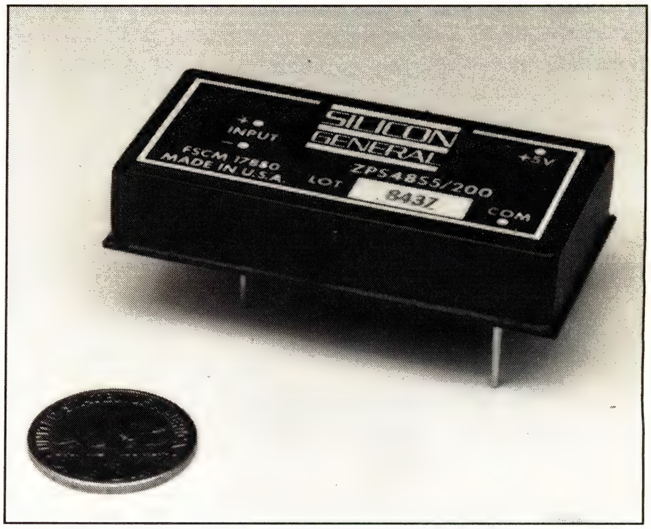
Six models of quad-output 100-W switching power supplies in the 4110 series are each fabricated on a single 4-by-8-by-2-in. printed-circuit board that weighs 22 oz, making them recommended for microprocessor-based systems or other applications where savings in space and weight are critical. Each model delivers output combinations of 5 V and 12 V dc. In addition, each model has a completely isolated output of either 5, 12, 15, or 24 V dc, eliminating interference with system-integrated CRTs or other sensitive system circuits.



In quantities of one to nine, the 4110 series models are priced at $139. Availability is from stock in eight weeks.

Power General, 152 Will Dr., P.O. Box 189, Canton, Mass. 02021. Phone (617) 828-6216 [Circle 361]

Dc-to-dc converters buck power surges to 80 V



Under telecommunications operating conditions, a 1-W and a 1.5-W dc-to-dc converter will withstand surges to 80 V for a minimum of 100 ms. The ZPS 48S05/200 and ZPS 48S05/300 are also able to withstand short circuits indefinitely at up to a 95°C operating temperature. Soft start occurs 50 times per second, so that the output does not experience transients when the short is removed. A shielded case minimizes electromagnetic and radio-frequency interference, while the high-frequency switching design and a low equivalent-series-resistance input capacitor minimize conducted input noise.

In quantities of 100, the 1-W ZPS 48S05/200 is priced at $38; the 1.5-W ZPS 48S05/300 at $42. Delivery takes up to six weeks.

Silicon General Inc., Power Products Division, 940 Detroit Ave., Concord, Calif. 94518. Phone (415) 686-6660 [Circle 362]

GaAs microwave amplifier takes up little space

In a package measuring 0.46 in. wide by 0.25 in. high, the Picopak GaAs FET microwave amplifier further reduces its board-space requirement by locating the dc bias pin on the end of the package. Length varies with gain level, and sizes from 0.96 to 1.8 in. are available. Aluminum packaging is used because of its light weight and efficient heat-transfer properties; the Picopak can thus operate in temperatures to +125°C.

The Picopak offers multioctave bandwidths in the 0.5-to-18.0-GHz frequency range, and linear output power to +20 dBm can be provided.

For various custom configurations, the manufacturer will quote price and delivery time.

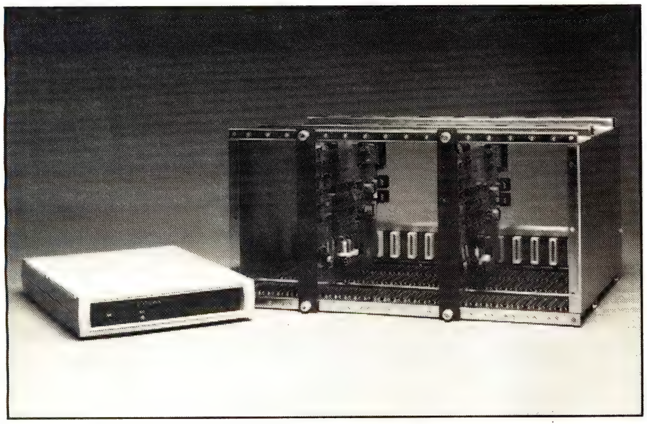
MicroWave Technology Inc., 4268 Solar Way, Fremont, Calif. 94538. Phone (415) 651-6700 [Circle 356]

Unit adds data-transfer capabilities to voice lines

Previously installed PBX telephone lines can accept Localink, a data-over-voice enhancement, with no additional wiring required. Once in place, Localink transmits data without interfering with simultaneous voice transmissions. A full-duplex product, Localink operates at speeds up to 14.4-kb/s over distances as great as 4 miles. Its protocols are transparent to the user.

Available in the second quarter of 1985, Localink will retail at a price of $500 for the stand-alone model, or $450 for the central-site model.

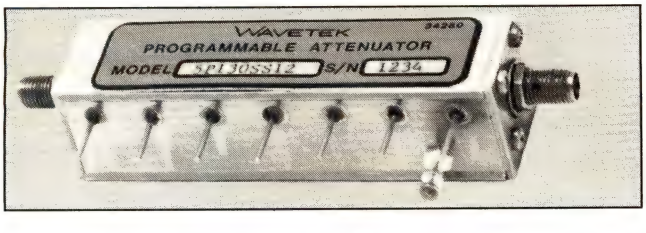
Racal-Milgo Inc., 8600 N.W. 41st St., Miami, Fla. 33166.
Phone (305) 592-8600 [Circle 354]



Programmable attenuator switches in under 6 ms

A 5-W programmable attenuator with a 50-Ω impedance and a voltage-standing-wave ratio of less than 1.3:1 (17-dB return loss), the series 5PH has a switching speed of less than 6 ms. The frequency range is from dc to 120 MHz. The series 5PH's standard operating voltage is 12 V, but it is also available in 5, 6, 9, 18, and 26 V. The series 5PH can be configured with one to seven cells, and individual cell attenuation is 1 to 32 dB. Greater attenuation accuracy can be specified when the frequency range of operation is reduced—a trade-off for precision intermediate-frequency attenuator applications.

Excluding standard connectors, the case is 4.57 cm wide and 2.03 cm high; length equals 1.113 times the number of cells specified plus 0.305 cm. The series 5PH operates in the temperature range of –55°C to +71°C and is typically priced at $550, with delivery in 8 to 12 weeks. The standard ½-W model, out of which the high-power series 5PH was developed, is priced from $150 to $500 and can be shipped in eight weeks.

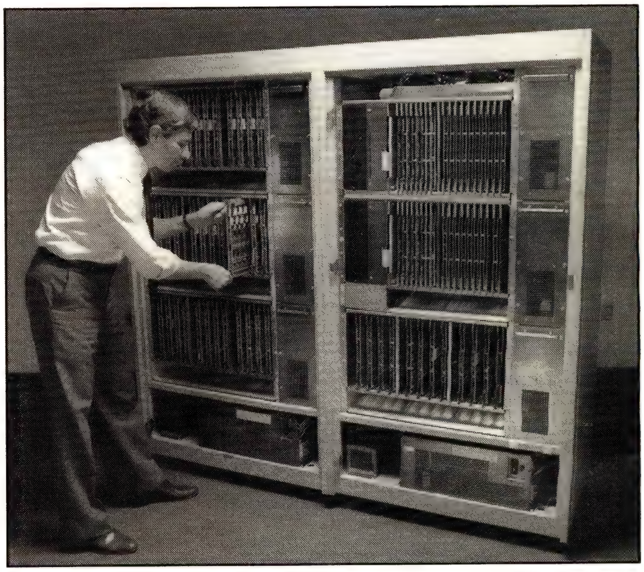


Wavetek Indiana Inc., 5808 Churchman St., P.O. Box 190, Beech Grove, Ind. 46107. Phone (800) 851-1202 or (317) 788-5975 [Circle 355]

Telephone networking switch seeks cost-effective routes

Promising up to 30% savings in routing costs, Harris Corp.'s 20-20 Integrated Networking Switch automatically routes every call and data transmission along the most cost-effective path, whether public or private.

The digital tandem voice/data switching system has flexible modular architecture, advanced networking control features, pulse-code modulation, and a nonblocking design that supports up to 1,920 calls at once.



Featuring a network traffic-reporting facility that stores up to 25,000 call records on the system's hard disk and eliminates the need for external buffers, the system can be configured with an optional redundancy feature, ensuring 100% up-time, even during servicing.

Prices range from about $68,000 to about $1 million, depending on options. Delivery will begin in March.

Harris Corp., Digital Telephone Systems Division, Novato, Calif. 94948. Phone (415) 472-2500 [Circle 383]

Modem speaks in natural-sounding tone

The LVM Business Communicator product line has been enhanced by the addition of a dual-tone multifrequency modem that responds to incoming calls in a natural-sounding voice. Each modem supports one line, and eight lines can be housed in a standard chassis consisting of a card-rack front and integral power supply. Weighing 16 lb, the chassis measures 17.12 in. wide, 7 in. high, and 16.5 in. deep.

The modem has standard Bell 407 compatibility, a full-duplex feature that allows tone-key information to be entered simultaneously with voice output. An internal data-access arrangement eliminates the need for external equipment.

The modem automatically answers and terminates phone calls, and when used with the manufacturer's automatic calling unit, originates calls and transfers them to human operators. An I/O module works with the module in data-entry systems such as credit-checking terminals.

Tagged at $700, the modem is available in 30 to 45 days. The automatic calling unit costs $1,000 and will also be shipped in 30 to 45 days.

Votrax Inc., 1394 Rankin St., Troy, Mich. 48083.
Phone (313) 588-2050 [Circle 363]

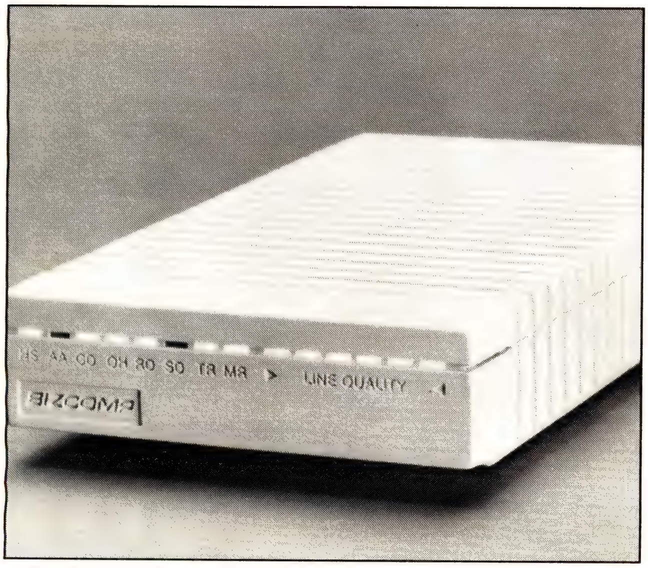
Modem creates voice and data work station

Personal computer users can add to their machines a telephone and voice capability with the IntelliModem Ext, a stand-alone 300- to 1,200-baud communications modem that is Hayes-compatible. At board level, the manufacturer offers three plug-in boards for the IBM Corp. Personal Computer: the IntelliModem ST, the IntelliModem XL, and a half-card IntelliModem XT.

Eight LED indicators show modem status, while a front-panel bar graph displays line quality, spotting error-prone marginal phone lines. Advanced call-progress detection senses signals such as busy, dial tone, remote ringing, and voice, and reports these conditions on the computer terminal's screen.

Deliveries will begin in March, with prices pegged at $349 each in 10-unit quantities.

Bizcomp Corp., 532 Mercury Dr., Sunnyvale, Calif. 94086.
Phone (408) 733-7800 [Circle 364]

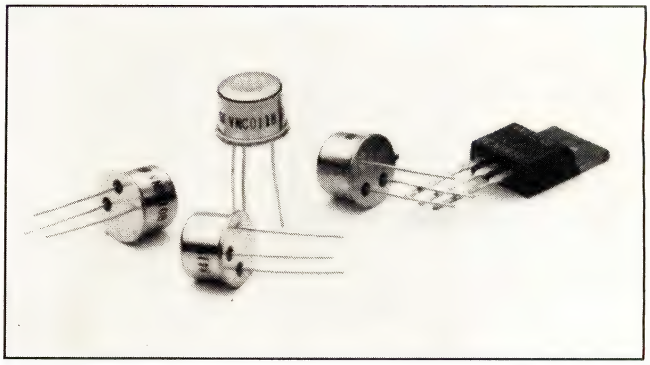


Power transistors are logic-compatible

A family of 12 Mospower devices offers low threshold voltages and are CMOS-logic compatible. The components are designed for interfacing control logic with electromechanical parts.

The family comprises two series of different thresholds. The 010 series has a turn-on threshold of 2 V maximum. The VNC010, VND010, and VNE010 parts feature a drain current of 4 A, an on-resistance of 0.5 Ω, and breakage voltages of 60, 80, and 100 V, respectively. For system applications that require greater noise immunity, the 011 series (VNC011, VND011, and VNE011) is available with identical power ratings and a guaranteed threshold voltage of no more than 3.6 V. Each of these parts is available in either the TO-220 plastic or TO-39 package.

Other features of the family are high input impedances, low drive requirements, and a square safe operating area curve. An internal diode with full current capability eliminates the need for an external discrete diode in many cases.



Available now, the 2-V-threshold 010 series is priced from $3.28 to $3.90 each (in quantities of 100 to 249) in the TO-39 package and from $3.38 to $4.02 each in the TO-220 package. For the 3.6-V-threshold 011 series, prices range from $2.95 to $3.46 each for the same quantities.

Siliconix Inc., 2201 Laurelwood Rd., Santa Clara, Calif. 95054.
Phone (408) 988-8000 [Circle 372]

Filters eliminate emi above 60 MHz

Varistor-capacitor electromagnetic-interference filters remove fast-rising transients and high-frequency emi between 2 and 200 MHz. The three-terminal DSS710 part has a three-lead varistor-capacitor configuration and can be mounted on a printed-circuit board.

An integral ferrite bead forms a T-shaped filter circuit to suppress emi. The circuit also functions as a bypass capacitor while permitting surges greater than 22 V to flow to ground. It can safely ground surges up to 500 and 600 V.

In lots of 50,000, the filters cost less than 20¢ each.

Products can be delivered in six to eight weeks.
Murata Erie North America Inc., 1148 Franklin Rd. S.E., Marietta, Ga. 30067. Phone (404) 952-9777 [Circle 373]

Thick-film resistors are for surface mounting

Thick-film-resistor networks in chip-carrier configurations are designed for use in automatic surface-mounting equipment. The LCCC series of chips requires a minimum of space with a maximum seated height of 0.09 in. and standard 0.05-in. lead spacing. The ceramic-body networks are customized through variations of two basic schematics: the 01 schematic provides a choice of 15 or 23 resistors connected between a common lead and a discrete printed-circuit-board connection; the 05 type provides seven resistor pairs with each pair connected between ground and a common line. Customers can also specify custom resistor/capacitor schematics.

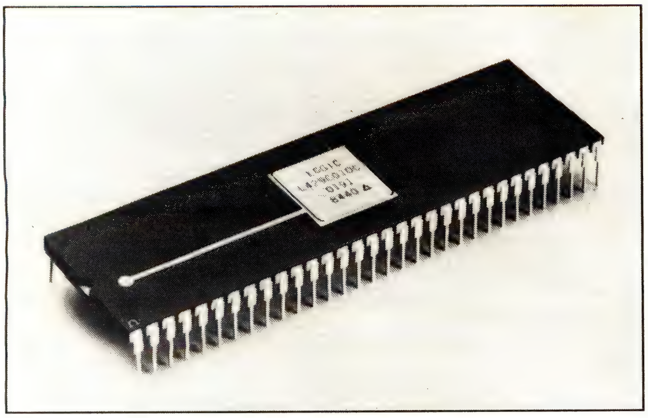
The networks are targeted for military applications such as aircraft, submarines, and torpedo guidance systems. Each network is subjected to MIL-R-83401 group A screening.

The thick-film resistors have individual power ratings of 0.15 W. Depending on the network, package power ratings range up to 1.10 W. Resistance ranges from 100 Ω to 100 kΩ, with tolerances of ±5%. The temperature coefficient is 100 ppm/°C over an operating temperature range of –55°C to +125°C. With a lead time of 8 to 12 weeks, the devices are priced from $2.50 to $3, depending on schematic and testing.
Dale Electronics Inc., P.O. Box 609, Columbus, Neb., 68601. Phone (915) 592-3253 [Circle 374]

CMOS bit-slice processor combines multiple functions

Faster, smaller, and more efficient than its conventional predecessors, the L429C01 bit-slice processor combines functions equivalent to four of another manufacturer's bit-slice arithmetic logic units, one carry look-ahead unit, and pipeline registers for control inputs on a single CMOS chip.

Typical cycle times for the 16-bit-slice processor are 10 MHz for the military-grade part and 12 MHz for the commercial version. Its maximum power consumption of 200 mW (military) and 150 mW (commercial) can save up to 4 W over multiple bipolar circuits with similar capabilities.



The L429C01 is downward-compatible with those bipolar chips through microcode. All status, shift-linkage, and carry functions can be cascaded to combine units into architectures of 32 bits and larger.

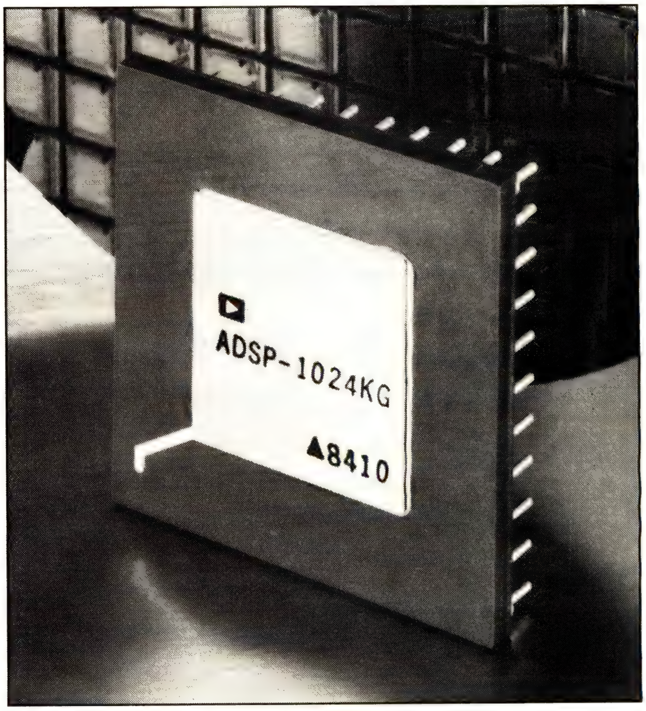
Contained in a 64-pin DIP, the chip will be available in March. Pricing for the commercial-grade part is $80 each in 100-unit lots; military-grade prices are available on request.
Logic Devices Inc., 628 E. Evelyn Ave., Sunnyvale, Calif. 94086-6459. Phone (408) 720-8630 [Circle 340]

24-by-24-bit multiplier is precise and economical

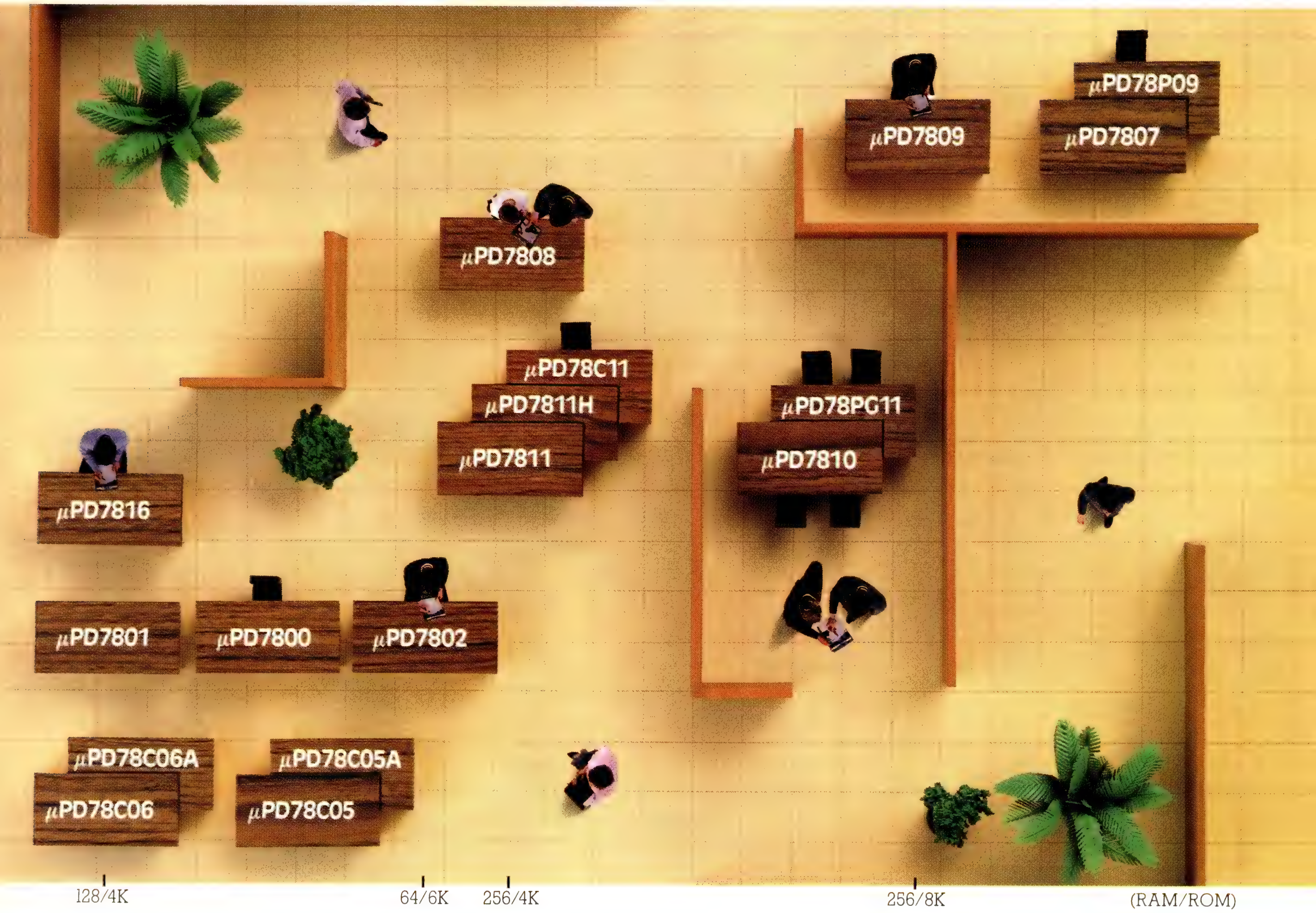
A midrange alternative to both 16-bit fixed- and floating-point multipliers, the ADSP-1024 parallel array is a 24-by-24-bit CMOS chip with a worst-case multiplication time of 195 ns and power dissipation of 200 mW. This suits it for digital-signal-processing applications where 16-bit multipliers are inadequate and floating-point solutions are not required.

The multiplier, which has two input ports and one output port, multiplexes the most and least significant products through the output port in a single cycle. Thus it can produce a full 48-bit product without sacrificing throughput.

The ADSP-1024 is less expensive than floating-point solutions and more precise than 16-bit fixed-point multipliers, the company says. It comes in four grades—two commercial (the K and J versions) and two military (the S and T versions).



Move ahead with our powerful 8-bit microcomputer μCOM-87 Family.



NEC's proprietary μCOM-87 single-chip 8-bit microcomputer family blends advanced features that mean success. They raise performance and reduce size in a vast application range from OA, control and automotive to consumer products.

High system expandability is assured with 8080AF and 8085A bus-compatible architecture. Abundant and powerful instructions are provided. A large-capacity memory, up to 8K, is built-in. Memory space can be expanded to 64K. Diverse on-chip hardware ranges from a serial interface, UART, A/D converter and comparator to a watchdog timer. Finally, the 64-pin package offers ample I/O pins.

Give your products a leading edge with one of today's foremost 8-bit single-chip microcomputers. The NEC μCOM-87 family.

	μPD7801 /μPD7802	μPD78C06A	μPD7816	μPD7811 /μPD7811H	μPD7808 /μPD7809	μPD78C11
TECHNOLOGY	NMOS	CMOS	NMOS	NMOS	NMOS	CMOS
CYCLE TIME (μSEC)	2.0	4.0/2.0	1.5	1.0/0.8	1.0	1.0
ON-CHIP ROM (BYTE)	4096/6144	4096	4096	4096	4096/8192	4096
ON-CHIP RAM (BYTE)	128/64	128	128	256	256	256
EXPANDABLE MEMORY (BYTE)	60K/58K	60K	—	60K	60K/56K	60K
I/O LINES	48	46	44	44	48	44
ROMLESS VERSION	μPD7800	μPD78C05A	—	μPD7810 /7810H	μPD7807	μPD78C10

NEC Electronics Inc.
401 Ellis Street, Mountain View, CA 94043.
Tel: 415-960-6000. TWX: 910-379-6985.

NEC Electronics (Germany) GmbH
Tel:0211-650302. Telex:8589960 NEC D.

NEC Electronics (UK) Limited
Tel:0698-732-221. Telex:777565 NEC UKG.

NEC Electronics (France) S.A.
Tel:1-609-9004. Telex:203544 NEC EF F.

NEC Electronics Italiana S.R.L.
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In quantities of 100, the 195-ns K model sells for $192 and the 250-ns J model for $154. Prices for the military-grade models are available on request.

Analog Devices, Route 1 Industrial Park, P.O. Box 280, Norwood, Mass. 02062. Phone (617) 329-4700 [Circle 341]

High-speed logic array has on-chip memory

Featuring 1,600 configurable gates and 1,280 bits of dedicated high-speed static RAM, the QM1600S logic array offers word-width programmability of from one to 40 bits at the metal-mask level, with a worst-case access time of 6 ns.

The QM1600S memory is composed of a pair of 640-bit RAMs, operable in single- or dual-port modes. The addition of a mode-select control allows direct memory access from off the chip as well as on, thereby simplifying testing of the RAM blocks.

The circuit's logic operates at equivalent gate-delays of 0.5 ns, and speed/power programmability at the macro level permits gate-delay selection of 275, 350, 500, and 700 ps, keeping power consumption at 4 W.

Designs using the QM1600S macro library will be supported on the Tegas logic simulator and on Daisy, Mentor, and Valid engineering work stations. Automatic layout of the array is supported by proprietary software that can be adapted to a variety of computers for customers with multiple design requirements. Design training courses are provided to help customers in implementing the circuit.

Prices are determined on an individual basis, depending on the complexity, quantity, packaging, and performance capability of the given circuit; prototypes are available in six to eight weeks from the completion of logic simulation.

Applied Micro Circuits Corp., 5502 Oberlin Dr., San Diego, Calif. 92121. Phone (619) 450-9333 [Circle 342]

3-μm CMOS arrays have up to 3,000 gates

A complete line of 3-μm CMOS gate arrays and standard cells from Mietec is based on an oxide-isolated n-well polysilicon process developed for high speed and minimum power consumption.

The company, based in Belgium, developed the process to reach TTL speed while keeping power consumption at CMOS levels. Available in configurations of 500, 1000, 1,500, and 3,000 gates, the gate-array circuits feature single-level polysilicon and either single- or double-level metal layers.

The gate array library includes more than 200 macro cells, the company says, among them programmable I/O cells used to achieve flexible I/O design facilities without losing standardization.

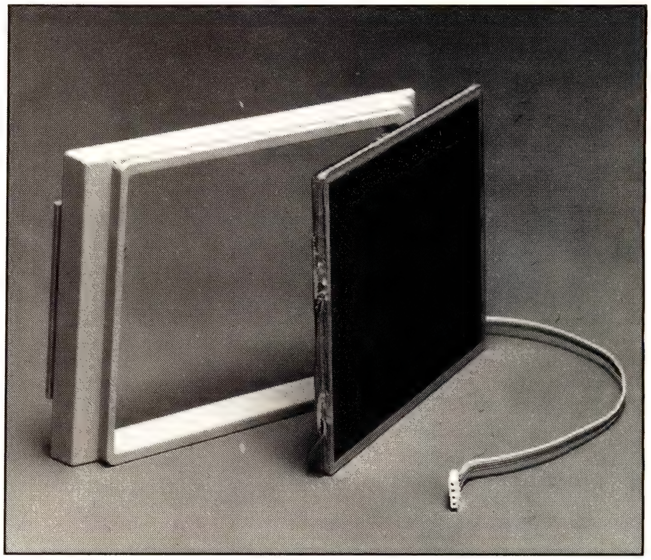
On a turnkey basis, engineering charges for the 500-gate array begin at about $17,500, with quantities of 1,000 in 40-pin plastic packages averaging about $5 each. Prototypes require two to three months' lead time.

Mietec's standard-cell library is compatible with the gate-array library, meaning that gate arrays can be upgraded to standard cells without redesigning them. Designed to optimize silicon, the standard cell features double-level polysilicon and single- or double-layer metalization.

Turnkey engineering costs for the standard cell begin at $27,500; prototype lead times run from 16 weeks.

Mietec, U.S. Sales Office, Twin Forks Office Park, 6040B Six Forks Rd., Raleigh, N.C. 27609.
Phone (919) 847-7200 [Circle 343]

Liquid crystal shutter makes CRTs color-capable



Providing color for a monochrome CRT has traditionally depended on the use of shadow masks or penetration-tube technology. The 7-in. liquid crystal shutter from Tektronix, however, offers the user color capability without sacrificing resolution or requiring high-voltage switching.

The liquid crystal shutter features high resolution, a larger usable viewing area, inherent convergence, and good contrast in ambient light. The unit comes in a small, rugged package.

The shutter consists of a fast liquid-crystal switch, called a pi-cell, sandwiched between two color polarizers and a neutral polarizer. Colored images are generated by rapidly switching the cell. First, only one field—green, for instance—is transmitted by the shutter, and all information to be colored green is put on the screen. Next, the cell switches to transmit only the red field, and all red information is written. The switching is so rapid and repetitive that the human eye integrates the two into one image. Information written in both fields appears yellow, thus giving the shutter a three-color *palette*. Additional palettes will be available.

Tektronix is also offering a 7-in. monochrome CRT with red and green phosphor that optimizes shutter performance. Both units will be sold by contract only.

Single shutters sell for $200; Discounts for original-equipment manufacturers are available on large-quantity orders. Delivery of orders of up to 500 units can be met within two weeks of receipt of order.

Tektronix Inc., P.O. Box 500, Beaverton, Ore. 97077.
Phone (503) 644-0161 [Circle 381]

Soldering system can reach work temperature in 10 s

With its heating element built into its tip, users of the Sta-Temp soldering system can grip the unit within 1½-in. of their work, affording increased operator control over conventional irons.

The system relies on Metcal's Self Regulating Temperature Source to maintain precise, metallurgically controlled temperature across a wide range of thermal loads. Capable of reaching full soldering temperature in just 10 s (about one third the time of other irons), the SR/TS system replaces controls, thermistors and thermostats that bulk up other soldering tools.

The standard 300°C operating temperature of the unit eliminates the thermal damage associated with the higher operating temperatures in conventional irons. Tip cartridges, costing $8.75 each, come in several different geometries and snap into the instrument for immediate use.

The Sta-Temp VIP soldering system is priced at $495, and includes a work stand (called the "tower of power"), a 13.56-MHz constant-current power source, an instrument, and one tip cartridge. Delivery is in two weeks after receipt of order.

Metcal Inc., 3704 Haven Court, Menlo Park, Calif. 94025. Phone (415) 366-3777 [Circle 382]

Wafer-polishing system accurate to 3 microns

Flatness control to 3 μm is possible with the Spitfire System 180 single-sided polishing machine. Controlled by a computer from Allen-Bradley Co., the system can process two to three operations per hour, with each load carrying from 18 8-in. wafers to 48 4-in. wafers. Offering one-button operation, the polishing process is waxless, thus increasing rates and eliminating waxing costs.

Standard process set points are provided to meet basic requirements within tight process parameters. Customers can then vary set points as needed for proprietary processes. The machine is available with a 54-in.-diameter polishing platen and features six planetary, rotating wafer carriers. A CRT continuously displays and updates process performance data. Because a basic system is customized to customer needs, the company needs such specifications before listing prices and delivery times.

Kayex Corp., 1000 Millstead Way, Rochester, N.Y. 14624.
Phone (716) 235-2524 [Circle 377]

Small superminicomputer has power of two VAX 11/780s

The PowerNode 6031 superminicomputer concentrates the computational power of as many as two VAX 11/780 systems into half the size at half the price. The $89,000 basic system sits in a 30-in.-high desk cube. The computer is based on a proprietary 32-bit processor and UTX/32 operating system, an implementation of Unix 4.2BSD and Unix System V. The system has 64-K bytes of dynamic RAM, and can support 32 terminals.

The PN6031 is suitable for use as a general-purpose multiuser Unix system or a back-end computational node. It can also be used as a network file server. The company is now making deliveries.

Gould Inc., P.O. Box 9148, Fort Lauderdale, Fla. 33310-9148.
Phone (305) 587-2900 [Circle 370]

Video digitizer converts images for Macintosh

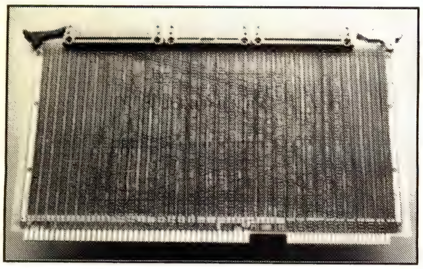
A video digitizer converts video signals into high-resolution images on Apple Computer Inc.'s Macintosh computer. The Mac Private Eye accepts signals from any standard NTSC source—a black and white or color TV camera, a TV monitor, or a video cassette recorder.

The digitizer captures an image in real time (1/30 s) and buffers it in memory. Moving images can be recorded because multipasses by the camera are unnecessary.

Each video frame is converted into a 512-by-512-pixel image that the user can view on the Macintosh. Images can also be manipulated with MacPaint software and stored in MacPaint files. Each image requires from 20-K bytes to 25-K bytes of memory. The system sells for $595 and will be available in March. A fully compatible black and white TV camera is also available for $225.

I/O Video Inc., 222 Third St., Cambridge, Mass. 02142.
Phone (617) 547-4141 [Circle 371]

MATERIALS □ SUPPLIES □ ACCESSORIES



A Multibus-compatible board, Unilayer II can accommodate up to 144 16-pin DIP equivalents. The I/O supports a general header area—222 I/O connections—in addition to the Multibus standard P1 and P2 edge connectors. An alternative to multilayered printed wiring boards, Unilayer II offers equally dense component layout and wiring capability, the manufacturer says. In quantities of 10, the Unilayer II board is priced at $154.25 each; in quantities of 100, the price is $91 each. Delivery takes three weeks.

Augat Inc., Systems Division, 40 Perry Ave., P.O. Box 1037, Attleboro, Mass. 02703. Phone (617) 222-2202 [Circle reader service number 421]

Premixed and frozen adhesives, sealants, and potting materials eliminate small-batch production-area mixing and reduce workers' exposure to allergens. This firm offers two-component epoxy, silicone, polyurethane, and polysulfide in labeled plastic syringes and caulking cartridges. Evaluation samples are available.

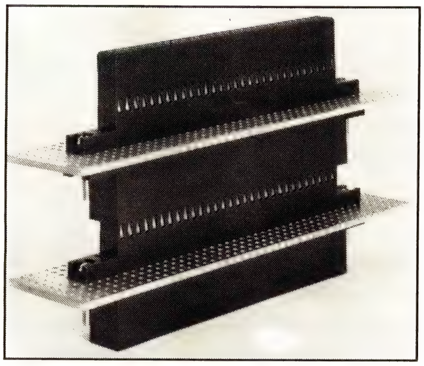
Appli-Tec Inc., P.O. Box 6038, Newburyport, Mass. 01950. Phone (617) 465-5101 [Circle 422]

Relays and microwave communications are among the applications for permanent-magnet material F340, an isotropic Ceramic I material. F340 features remanence of 2,400 G and coercivity of 2,000 H; its maximum energy product is 1.25 x 10^6 BH.

D. M. Steward Manufacturing Co., P.O. Box 510, Chattanooga, Tenn. 37401.
Phone (615) 867-4100 [Circle 423]

An insertion or extraction force of 2.5 oz/pin (average) is featured by this pin-grid-array socket line, which comes in over 100 footprints, from 12 to 289 pins, as well as in custom designs. The six-finger contacts are fabricated in beryllium copper, and all sockets are available with Kapton or Mylar Peel-A-Way. Terminals are available in standard and superlow profiles as well as wrapped wire. Samples are available from the manufacturer.

Advanced Interconnections, 5 Division St., Warwick, R.I. 02818.
Phone (401) 885-0485 [Circle 424]



Internal parallel pc-board stacking is made possible by the 60-circuit Go-Thru system, a post-and-receptacle interface that also provides interconnections for peripherals on a personal computer. The header uses 0.025-in. square phosphor bronze pins with star configuration, and the female connector uses a dual beam box-type contact. The base material is phosphor bronze, gold-plated in the mating area and tin-plated in the pin-trap area, both over 50 μin. nickel overall. The manufacturer will furnish specifications and pricing, in thousands.

Molex Inc., 2222 Wellington Ct., Lisle, Ill. 60532. Phone (312) 969-4550 [Circle 426]

Nylon board hardware can be installed over circuit paths on the pc board to electrically isolate a circuit or space a number of pc boards. The line includes through-hole spacers, hex spacers, standoffs, and push-in locking spacers that are self-fastening. The corrosion-resistant nylon 6/6 material has a melting point of 500°F and carries a Underwriters Laboratories rating of 94V-2. Delivery is stock to four weeks; a 1/4-in. hex spacer is priced at $0.025 each in 1,000-piece lots.

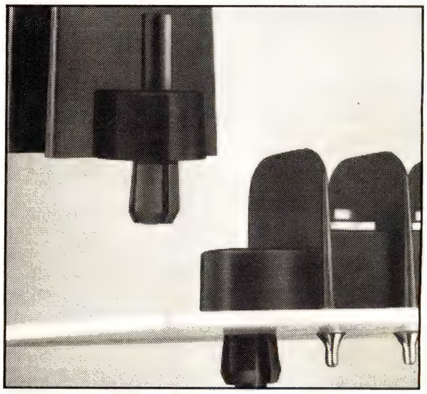
Midland-Ross Corp., 2055 Gateway Pl., Suite 300, San Jose, Calif. 95110. Phone (408) 993-8000 [Circle 429]

STD motherboards with up to 13 edge connectors and spacing on ⅝-in. centers fit into the model 720-050 STD bus box. The model 720-050 offers integral cable channels and pads for mounting disk drives, CRTs, or other mechanical equipment. Front and rear panels are removable, for mounting meters, switches, displays, and connectors. Available now, the STD bus box is priced at $90 per unit.

Pro-Log Corp., 2411 Garden Rd., Monterey, Calif. 93940. Phone (408) 372-4593 [Circle 425]

Large-particle ("J") solder pastes are offered for reflow soldering in the temperature range of 215°C to 220°C. The –200/+325-mesh powders are said to prevent solder balls from forming, under conditions where very fine solder particles will flow away from the main mass of alloy and become isolated. The solder pastes are available in varying compositions of tin, lead, and silver.

Electro-Science Laboratories Inc., 2211 Sherman Ave., Pennsauken, N.J. 08110. Phone (609) 663-7777 [Circle 427]



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IS THE COMEBACK MYTH OR REALITY?

Distribution industry leaders thought they spotted signs of recovery in August but now analysts think they jumped the gun

□ *by George Leopold*

New York

Electronics distributors and distribution analysts disagree over whether the industry has finally turned the corner on a slump that began during the second half of 1984 [*ElectronicsWeek*, Aug. 27, 1984, p. 67]. As most distributors try to put the best face on modest December and January gains, analysts argue that orders are flat and the industry's recent performance is lackluster.

Factors contributing to the modest pickup, distributors say, include fewer cancellations and reschedulings by customers as they began to reduce inventories in January, the continued strength in the military segments of their businesses, and an expected January ordering spurt. Less volatile segments, among them passive components and connectors, continue to hold steady. But the direction of the sagging market for personal computer products still remains a mystery.

During a three-week period in January, a number of buyers, such as large original-equipment manufacturers, worked off some inventory. But OEM inventories remain 15% to 20% too high, explains Thomas Kurlak, an industry analyst with Merrill Lynch, Pierce, Fenner & Smith Inc. Overall, distribution is in a holding pattern, asserts Kurlak, adding that about the only positive development he sees is an improving book-to-bill ratio for value-added very large-scale integrated-circuit products.

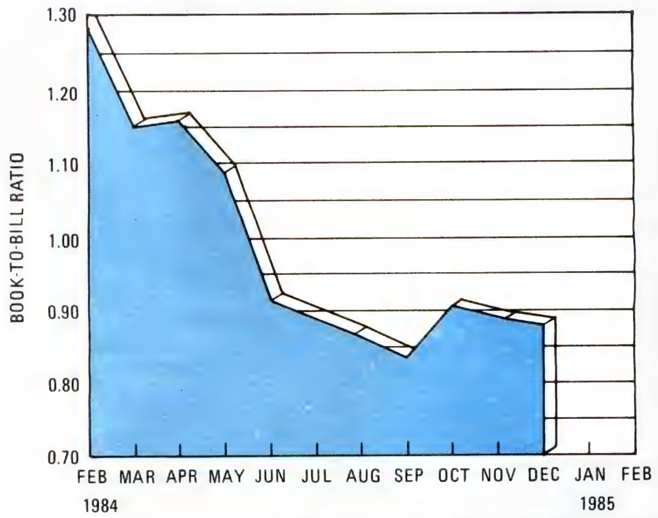
Conceding that its business continues to be flat, Anthony H. Hamilton, chairman and chief executive officer of industry leader Avnet Inc., says, "Inventories are gradually coming into line. Although I do not feel that there is going to be a dramatic upturn, I expect a gentle upturn in the near future." The near future means the second quarter, he adds.

"While we have had some serious reductions in prices on the 64-K and 256-K [dynamic random-access memories], I do not believe we are having similar crisis-type pricing as we had in previous recessions," continues Hamilton.

"We're keeping our fingers crossed and hoping that the January numbers indicate the beginning of a trend," says Ben Schwartz, head of semiconductor distribution for Diplomat Electronics Corp. For the first time in four or five months, Diplomat has been able to reduce inventories, including a $2.5 million net reduction last month. Schwartz expects similiar inventory reductions over the next several months.

Better business. "Our military bookings have more than doubled from last January," he adds, despite an 80% drop late last year after Texas Instruments Inc. ran into problems with the Pentagon over improper testing of its chips. Nevertheless, Schwartz expects Diplomat's military business will once again exceed $1 million during February.

"I think we've bottomed," agrees Ralph Ozorkiewicz, vice president of marketing for Kierulff Electronics Inc. "The military segment has been, by a wide margin, the strongest business over the past year," a trend he expects to continue.



SOURCE: NATIONAL ELECTRONIC DISTRIBUTORS' ASSOCIATION

Upturn ahead? A decline for distributors during 1984 might be checked by a modest January pickup. An upturn may still be months away, however.

Kierulff, primarily a components and systems distributor, achieved positive book-to-bill ratios in December and January for the first time in several months, adds Ozorkiewicz.

But Preston Heller, chairman and chief executive officer of Pioneer-Standard Electronics Inc., sees in the January performance of IC distribution the continuation of a trend that has lasted over the past six months. "New orders coming in were still reasonably strong," during that period, he reports, but "were more than offset by increased cancellation and rescheduling.

"There are a lot of products in strong demand, but very few where the demand exceeds the supply," says Heller. "For the market to really recover, it will take a total work-off of the inventory [held by customers] or a perception by the buyers that more shortages are coming, or some combination of both."

At Arrow Electronics Inc., ranked second among national distributors [*ElectronicsWeek,* Oct. 15, 1984, p. 39], there were fewer cancellations in January, which resulted in stronger net bookings, as customers' inventories come back into line. "I'd like to see a couple of good months together, then I'd be more optimistic," says Arrow president Stephen Kaufman. The distributor's book-to-bill ratio climbed from 0.7:1 in December to 0.9:1 in January, he reports.

Riding high. As some distributors express guarded optimism about a turnaround, others say business couldn't be better. Premier Industrial Corp., for example, expects record results for its distribution group for the fiscal year that will end May 31.

"Our electronics group has continued to show record results for the past year and a half," says corporate secretary Grant C. Grinnell. Business did slow during the second half of calendar 1984, "but we still had double-digit growth."

He attributes these results to Premier's specialization in one-stop shopping and fast delivery times for maintenance and repair as well as in small OEM and prototyping markets. "We take no orders for future deliveries of any sizable degree," Grinnell explains. "We don't even keep track of book-to-bill ratios."

Premier's attitude has insulated it from the ups and downs experienced by other major distributors, Grinnell argues. "We don't go up like those fellows do, yet all through the recession we've maintained growth over the past period of time."

The book-to-bill ratio of distribution's maverick, CAL-ABCO, never dropped below parity during the downturn and profitability continued even though business was slow, according to the distributor's president, Alex Sandel. "I'm not bound by the rules and regulations of the manufacturers," notes Sandel, whose firm specializes in Japanese ICs [*ElectronicsWeek,* Aug. 13, 1984, p. 29]. Of the distributors surveyed, he is nearly alone in predicting an upswing in the "beginning of the second quarter or sooner."

Got the hots. Along with military orders, the current hot products, distributors say, are dynamic and static RAMs, high-speed CMOS circuits, EPROMs and EEPROMs, gate arrays, and, to a lesser extent, leading-edge microprocessors. At least one analyst expects Japanese memory makers to lead the way in the 256-K DRAM market, as they did with 64-K DRAMs. But, says Gregory Richards of Morgan Stanley & Co., "The Japanese have no vested interest in driving these prices into the ground."

Gentle on his mind. Tony Hamilton, chairman and CEO of Avnet, sees a "gentle" upturn in business during the second quarter as inventories gradually come into line.

Nevertheless, a major symptom of the recent downturn for manufacturers and distributors alike has been price deterioration for memory products. "The pricing in dynamic RAMs has been nothing short of brutal," especially the 64-K DRAM market, according to Kierulff's Ozorkiewicz.

According to distributors, commodity 64-K DRAMs selling in the $5 range a year ago now cost from $2 down to $1.25 for Korean products. Prices for 256-K DRAMs generally range from $10 to $15, but figures as low as $8 have also been reported.

Current reductions represent the third wave of price cuts to hit the DRAM market, remarks Charles Clough, president of Wyle Laboratories' Electronics Marketing Group. "Pricing has probably bottomed out there," he asserts, as have prices for microcomputer- and peripheral-related products.

Spring thaw. Clough says Wyle's January business was about 8% better than its fourth quarter run rate, but adds, "I don't think that this signals a turnaround." November was the first month in which Wyle recorded inventory reductions and Clough thinks depletion of buyers' inventories will help the pricing situation. Based on this, he asserts, "Everything you see points to a May or June upturn."

Thanks to a decline in its rate of cancellations and reschedulings, Bell Industries' electronics group has been able to to ship 80% to 85% of its bookings within 90 days, instead of 180 days or more previously, reports Howard Franklin, the distributor's president. "We are definitely seeing a slight increase in the bookings," he adds.

As things now stand, distributors seem prepared for a slow first half. "I think it's going to be a tough marketplace through the first quarter and into the second," concludes Clough. Merrill Lynch's Kurlak is less optimistic, predicting an unsustained pickup in the spring and no turnaround until the end of the third quarter. ☐

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Letters

VMEbus rolls on, says Xycom

To the editor: Regarding "Is the VMEbus Losing Its Lead?," [*ElectronicsWeek*, Jan. 14, 1985, p. 30], Xycom's answer is an unqualified no. Design-ins are taking place at a rapidly increasing rate and many consumers are moving to production-volume ramp-up. I believe the problem is inaccurate market forecasting, rather than lack of market acceptance for VMEbus. And contrary to what's stated in the article, Xycom did not suffer setbacks last year, but is right on plan, encouraged by our 1984 performance.

As the article notes, difficulty in implementing input/output on the VMEbus has slowed its development cycle. Xycom is directly addressing the I/O need in the factory automation market. That's why we have merged our 10 years of microcomputer-based factory-automation experience with the world-standard VMEbus architecture. Today, we offer the broadest line of VMEbus I/O available.

James T. McEachen
Marketing Vice President
Xycom Inc.
Saline, Mich.

Racet not a TVC rep

To the editor: As chairman of the board for Racet, I'd like to clarify one thing in your excellent report "Japanese Have Yen for U.S." [*ElectronicsWeek*, Jan. 1, 1985, p. 34]. The article characterized me as "actively helping Tokyo Venture Capital line up other potential loans."

I am not actually involved in TVC's new investments' program. The TVC/Racet relationship is a close and thriving one, but we are not acting as its representatives.

Ron Johnston
Chairman of the Board
Racet Computes Inc.
Orange, Calif.

Nine in time

To the editor: On behalf of Adept Technologies, I'd like to clear up one point in your article "Direct-drive servos speed up robot" [*ElectronicsWeek*, Dec. 10, 1984, box, p. 34]. The AdeptOne robot can pick up and deliver nine components in 8.75 seconds, not just one component as stated in the article. Likewise, our closest competitor can pick up and deliver nine components (not one as stated) in around 25 seconds.

David W. Scarborough
Sales Applications Engineer
Adept Technology
Sunnyvale, Calif.

Adjectival acrimony

To the editor: I applaud the second half of your editorial in the Dec. 10, 1984 issue [p. 88], which lamented the fitting of phrases to project names in order to produce acronyms. You recommend that "The Department of Defense should put together a committee of lexicographers to review its acronymonous output."

The sentiment is noble. However, you may wish to consider taking your own advice. The *Random House College Dictionary,* revised edition, 1982, insists that the correct adjectival form of "acronym" is "acronymous."

L. Peter M. Payzant, P. E.
Sr. Telecontrol Engineer
Nova Scotia Power Corp.
Halifax, Nova Scotia

Webster's Ninth New Collegiate Dictionary, *1984, gives the adjective form of "acronym" as "acronymic." So already we have a committee of three—for just one word!* *–The editors*

Corrections

In "Robots Get Smart in Japan" [ElectronicsWeek, *Jan. 21, 1985, p. 15*], *the Hitachi robot pictured on p. 16 is not the one that is referred to and described by the article on p. 15.*

In the article "Has AI's Time Come at Last?" [ElectronicsWeek, *Feb. 4, 1985, p. 53*], *two members of the Carnegie Group Inc. were incorrectly identified in Fig. 2. Larry Geisel, president, is second from the left, standing, and Jaime Carbonell is seated in the center.*

In the new product announcement "Wafer-analysis system offers full automation" [ElectronicsWeek, *Feb. 11, 1985, p. 86*], *the price range given was incorrect. The correct price range is $37,000 to $98,000.*

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Editorial

HOW VALUABLE IS SOVIET SCIENCE?

After a four-year hiatus, the National Academy of Science is about to re-establish a formal scientific-exchange program with the Soviet Union. To that end, Frank Press, the president of the academy, met in Moscow at the end of January with a delegation from the Soviet Academy of Sciences. The discussion between the Americans and the Soviets culminated in a broad agreement that will permit the academies to resume joint sponsorship of scientific symposiums; until 1980, three were held every year with about a dozen scholars involved in each.

Scientists from both nations have been meeting informally during the years that the formal program was suspended, and presumably that would continue even under a new agreement. Also, at the January talks, a major goal of the U.S. side was to get the Soviets to agree to permit its most eminent scientists to take part so that the symposiums would be of value to both sides. For example, the Soviet Union has some world-class mathematicians whose work is of interest to their American counterparts.

That is all well and good, and as long as the meetings are restricted to pure research it is unlikely that U.S. scientists will give the store away in return for nothing. We agree that it is probably helpful for scientists who are well acquainted with one another's work to meet face to face and exchange ideas, not to mention vodka and bourbon. But it would be well for the U.S. side to remember just what triggered the suspension of the meetings: the sentencing by Moscow of scientist Andrei Sakharov to internal exile.

And is anyone in the U.S. still naive enough to believe that Moscow would not be discussing a detente with the U.S. academy if it felt that it had nothing to gain? As we pointed out in a similar context last summer, when the Institute of Electrical and Electronics Engineers was petitioned by its Soviet equivalent to re-establish a technical exchange program between the two, the Soviet Union has a great deal to gain and absolutely nothing to lose [*ElectronicsWeek,* July 30, 1984, p. 72].

Besides, it's not as though the scientists from both nations have been totally cut off from each other since the academies stopped putting together their symposiums. Not only that, but it's doubtful that scientists from the Soviet Union can be free and easy in their information exchanges as they keep glancing over their shoulders toward Moscow.

It would be nice to believe that the Soviets' interest is purely scientific and academic, their motives idealistic in the extreme. But the sad truth is that apolitical, altruistic incentives such as those simply no longer exist in this world—if indeed they ever did. This is particularly so at the levels of diplomacy where the two academies exist.

Still, it would be interesting to hear the Soviet reaction should the U.S. side suggest that Sakharov be permitted to attend a meeting in, say, New York. Not only that, but who would enforce the principle of freedom to attend a meeting? The Soviet academy? If this nation of laws has one immutable principle of international relations, it must be the encouragement in any prudent way possible of free movement for citizens of all nations.

We wonder if it is wise in the long run to look the other way, in view of what has happened to Sakharov and other dissident Soviet scientists, in order to give a small group of Americans access to Soviet science of dubious value. It seems to us that the meetings between individuals are quite sufficient to further the pursuit of scientific truth.

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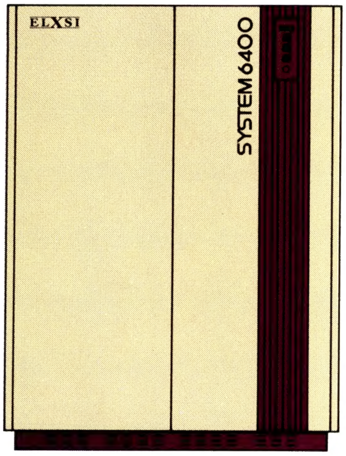

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